SERVICE MANUAL

MODEL 1540/1541
DISK DRIVE

Preliminary

APRIL 1985 PN—314002-01

commodore COMPUTERS

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Commodore Business Machines, Inc.
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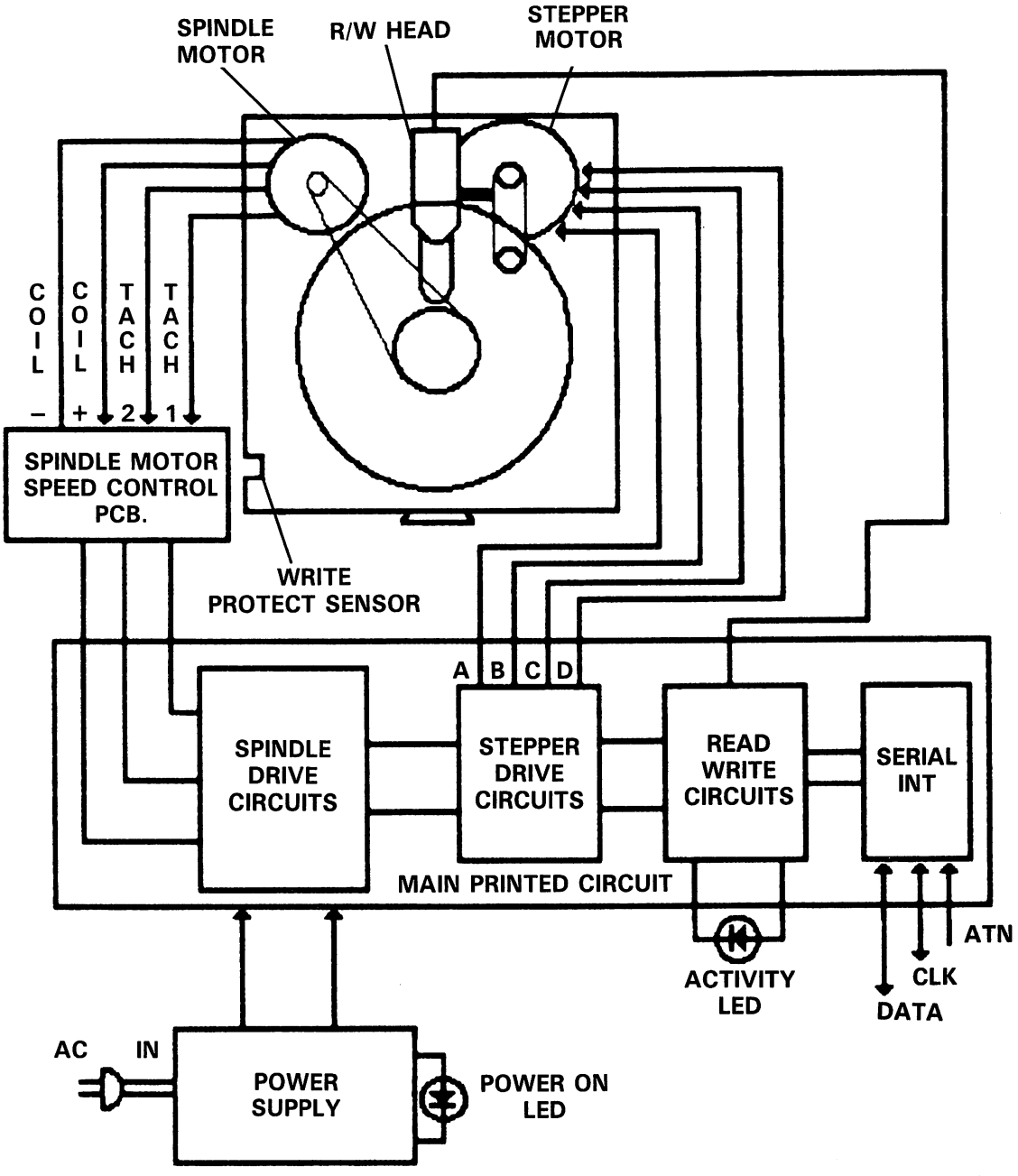
C1541 DISK DRIVE
PRODUCT SPECIFICATION

GENERAL DESCRIPTION	The C1541 Disk Drive is an external 5-1/4 inch floppy diskette recorder, offering high-speed and capacity for programs and data. It is an intelligent device, containing its own microprocessor, RAM, ROM and operating systems software for faster speed of throughput and memory efficiency in the computer.
MAXIMUM STORAGE	170K of data (formatted) — 35 tracks
MEDIA	5-1/4 Inch floppy disk. Single sided, single density, soft sectored (double density can be used, but not needed).
INPUT/OUTPUT	Commodore serial interface Second serial port for chaining a second drive or printer
CONTROLLER	MOS 6502 microprocessor — 1 MHz clock
MEMORY	2K RAM, 16K ROM
DATA TRANSFER RATE	400 Bytes/sec
FILE TYPES	Program, sequential, relative, random-access and user
NUMBER OF FILES	Up to 144 different files per diskette
COMPUTERS	C64, VIC 20, SX64, Educator 64, Plus/4, C16
MEDIA COMPATIBILITY	2031, 4040, C1551, C1571
POWER REQUIREMENTS	120 Volts AC, 60Hz — integral power supply with external 1 Amp fuse
POWER CONSUMPTION	30 Watts maximum

BLOCK DIAGRAM



CARE AND MAINTENANCE

- DO NOT use MAGNETIZED tools when repairing or adjusting a disk drive.
- DO NOT place a disk drive near any device which generates "noise" e.g., — motors, radios, televisions.
- DO NOT stack drives upon each other or in any way inhibit air flow around the unit. HEAT BUILD-UP can cause disk failures.
- Periodically CLEAN the read/write head with 90% isopropyl alcohol and a cotton swab. CHECK load pad for excess wear. Clean or replace as necessary.
- Take the following precautions when handling a diskette:
  ALWAYS store a diskette in its jacket.
  Use ONLY felt-tip pens when writing on the label of a diskette.
  Do not bend or physically damage a diskette.
  Do not place a diskette in the area of a magnetic field.
  Do not attempt to clean a diskette.
  Do not touch the exposed area of a diskette.
- DIAGNOSTIC and ADJUSTMENT procedures are outlined in detail on the diagnostic disk (Commodore Part #31405101). A manual has been added to the diagnostic package. It contains descriptions of testing procedures and adjustment methods.

OVERVIEW

The drive is itself an independent memory device. The drive is composed of a media clamp rotating mechanism, a head positioning mechanism and an eject mechanism. All positioning operations, excluding insertion and removal of the diskette, are controlled by the internal guide mechanism. Closing the front door causes the media clamp mechanism to operate. Two operations are performed in the following order:

a) The diskette is centered.

b) The diskette is clamped and retained between the spindle and the hub.

The spindle and hub rotate at 300 r.p.m. through a closed-loop control circuit employing a D.C. motor/tachometer. It is important that the relationship between the head and the media is maintained correctly during operation. For this purpose, a pressure pad is used to hold and press down the media (about 12g) from the opposite side of the head. This head assembly is coupled by a metal band to a four phase stepping motor which performs the track positioning. One step of the stepping motor corresponds to a 1/2 track movement. The control circuit on the logic board selects the direction and number of steps to the desired track.

The Read/Write head uses a glass-bonded, ferrite/ceramic head. Track-to-track erasing is accomplished by the straddle erase method. The surface of the Read/Write head is mirror-ground to minimize wear of the head and media. Also, the head is designed in such a way that the maximum signal can be obtained from the media surface.

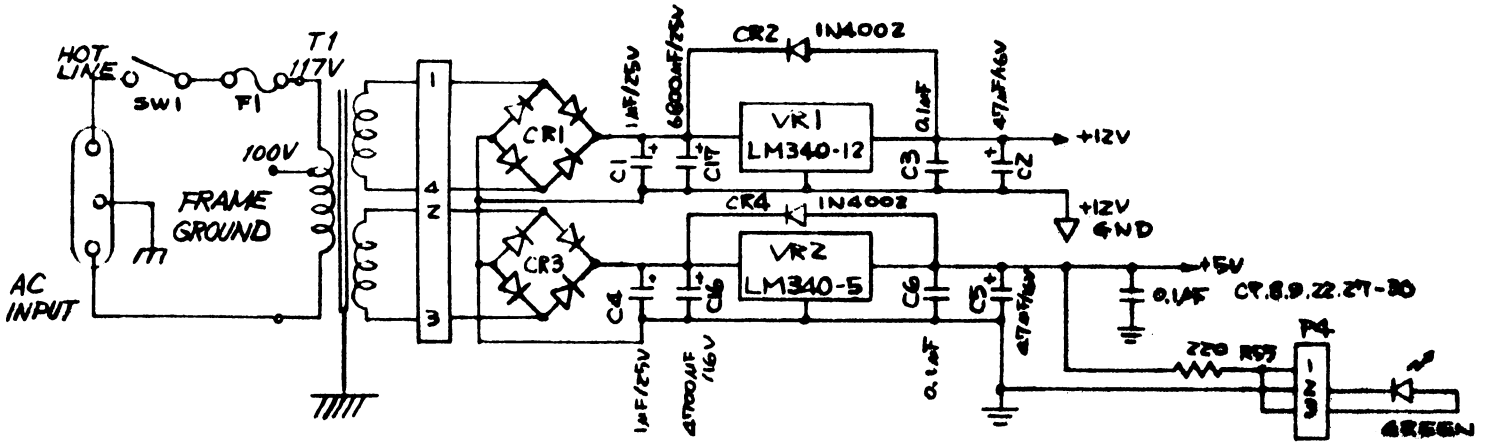
The spindle drive motor operates on 12 VDC and turns the spindle, through a belt drive, at 300 revolutions per minute. The speed of the drive motor is controlled by a feedback signal from a tachometer, which is housed in the drive motor assembly. The feedback signal controls a servo amp that supplies the 12 VDC drive current.

FLASH CODE

The 1541, upon power-up, goes through its own internal diagnostic. If an electronic problem is detected, it is indicated by a FLASH CODE. The LED's will blink a set number of times, pause, and then flash again until the problem is corrected.

Number of Flashes	Possible Failure
2	Zero Page
3,4	DOS ROM's
5,6,7,8	RAM

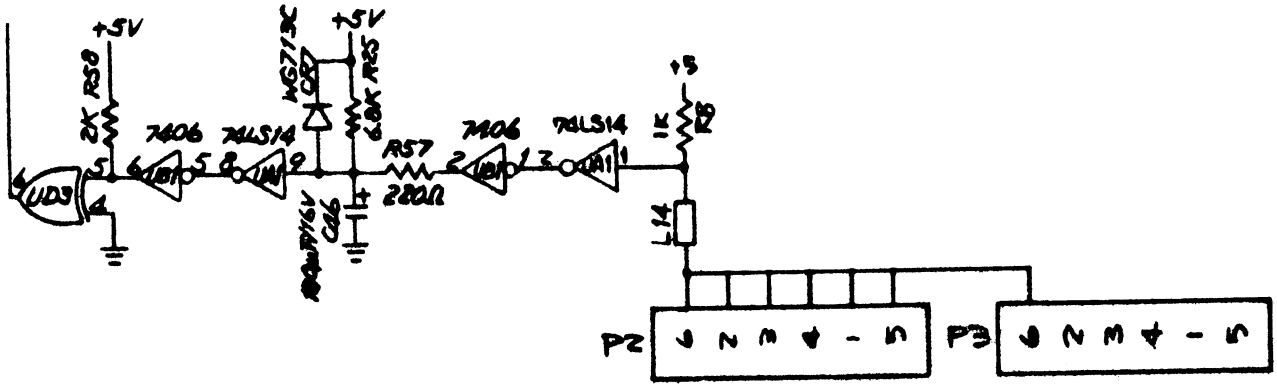
Circuitry associated with these components can also cause the failure code. Therefore, it should be suspected as the next possible defect.



All circuit diagrams have been taken from the short board schematic 1540049 unless otherwise noted. The short boards use a 6116 RAM which replaces the four 2114 I.C.s on the long board. See page 11 for the Read/Write logic differences.

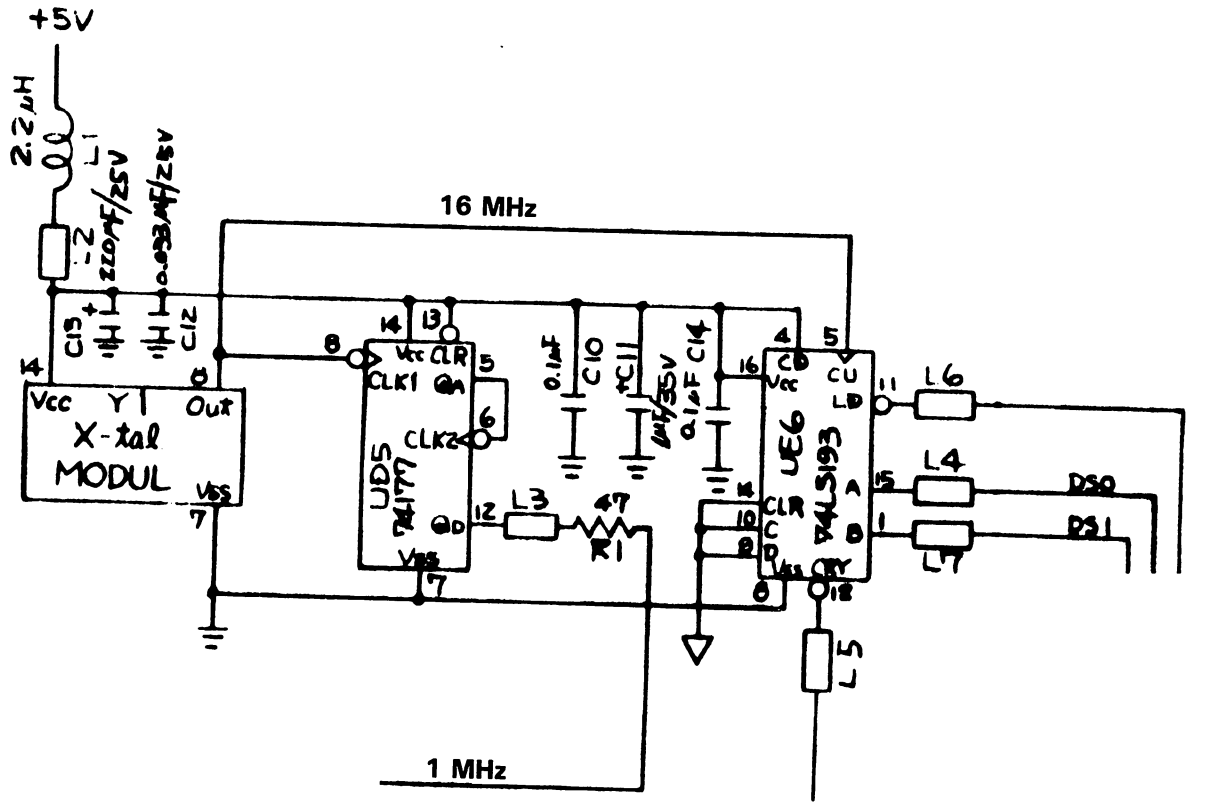
The Power Supply

The input AC voltage is controlled by switch 1 (SW1). Disk circuit protection is provided by fuse 1 (F1). If SW1 is closed, the AC voltage input is applied to the primary winding of transformer one (T1). T1 steps down the AC input voltage into two smaller AC voltages. The top secondary AC output (approx. 16VRMS) is converted to DC by the Full Wave Bridge Rectifier CR1. The DC output of CR1 is regulated at 12VDC by VR1. The bottom secondary AC output of T1 (approx. 9VRMS) is converted to DC by the Full Wave Bridge Rectifier CR3. The DC output of CR3 is regulated at +5VDC by VR2. High frequency filtering is provided by C1 and C3 for the 12VDC supply, and C4, C6 to C9, C22, C27 to C30 for the 5VDC supply. Low frequency filtering is provided by C17 and C2 for the 12VDC supply, and C5 and C16 for the 5VDC supply.



The Reset Circuit

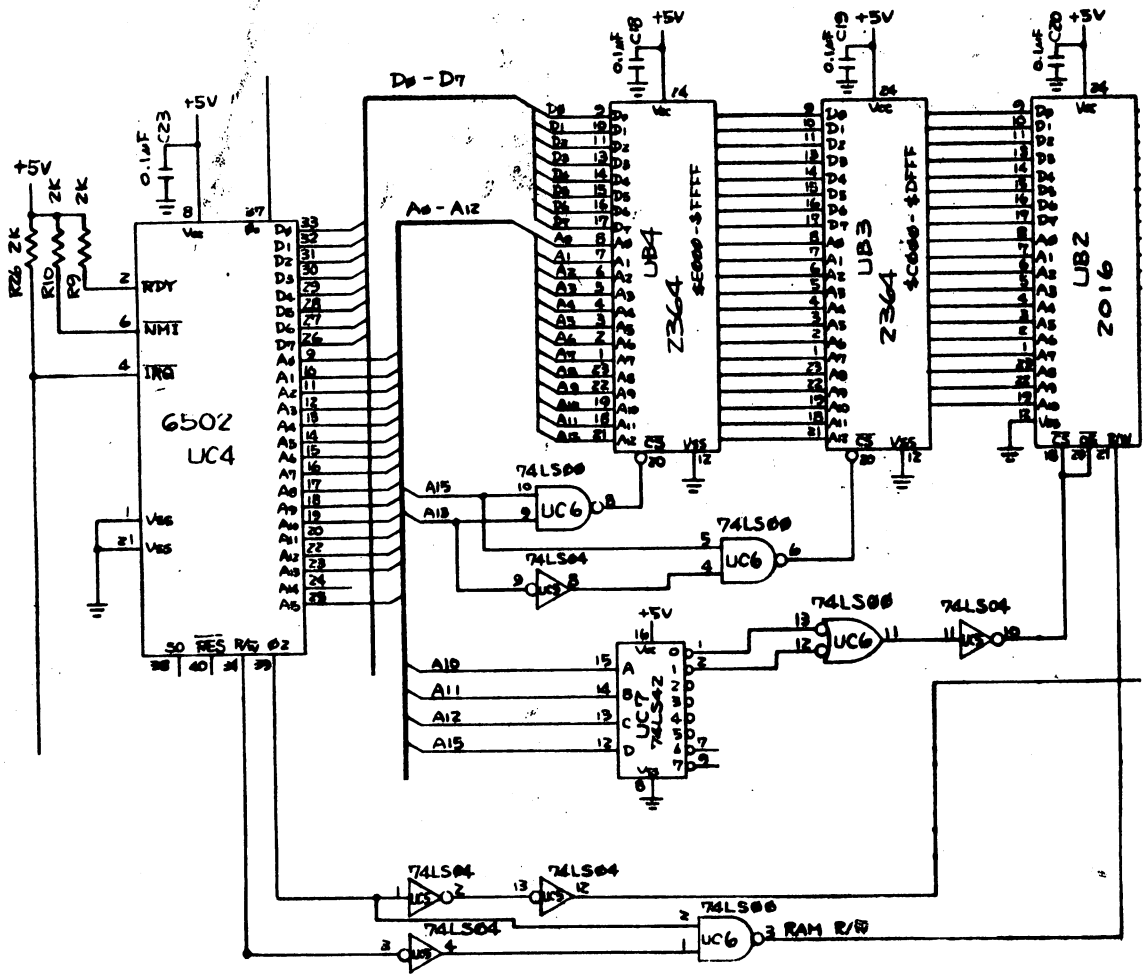
The output of the exclusive 'or' gate UD3 pin 6 will be "low" until C46 has charged through R25. Once the voltage across C46 reaches 2 volts, the output of UD3 pin 6 will go "high". This occurs when the disk is powered on, or a reset pulse is generated by a device connected to the serial bus. The reset pulse on the serial bus interface is input on, pin 6 of P2 or P3. This "low" to "high" going pulse on pin 6 of UD3 is input to the microprocessors reset interrupt input. This causes a restart or reset routine to be executed giving control of the disk drive operation to the Disk Operating System (DOS).



The Clock Circuits

Crystal Y1 outputs a 16 MHz clock signal. This is input to UD5 on pin 8. UD5 is configured as a ÷16 frequency divider. The output of UD5 pin 12 is a 1 MHz clock signal used as the system clock (Phase 0) for the microprocessor. UE6 is a programmable counter (÷16, ÷15, ÷14, ÷13) that outputs a varying frequency clock used to compensate for the difference in recording area/sector for sectors on inner tracks (Trks 1,2,3) as compared to sectors on out most tracks (Trks 33,34,35). The area/sector for inner tracks is less than the area/sector for out most tracks, so the recording clock frequency is increased when writing on inner tracks to keep the flux density constant. This clock output is on pin 12 of UE6.

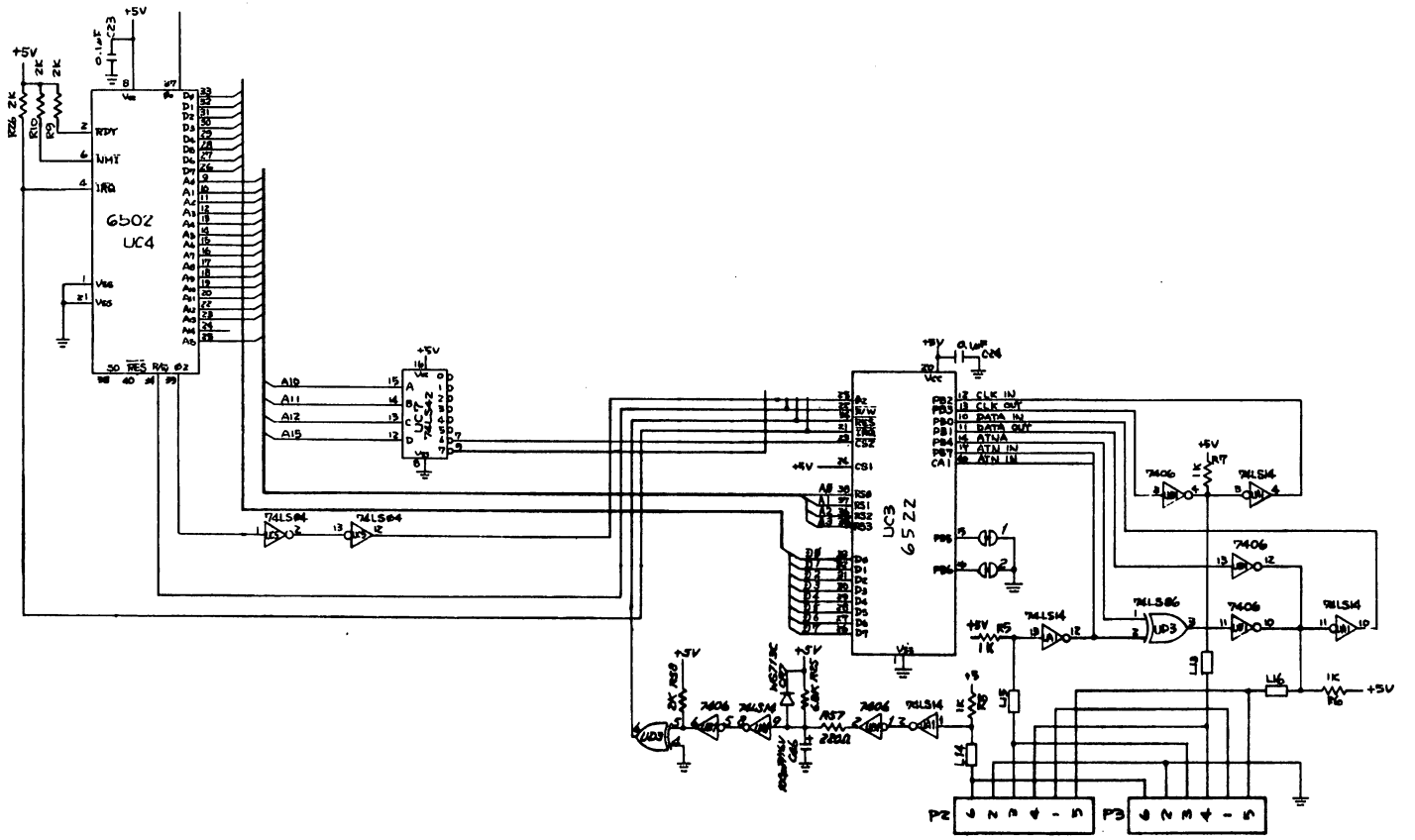
Tracks	Clock Frequency	Divide By
1-17	1.2307 MHz	13
18-24	1.1428 MHz	14
25-30	1.0666 MHz	15
31-35	1 MHz	16



Microprocessor Control of RAM and ROM

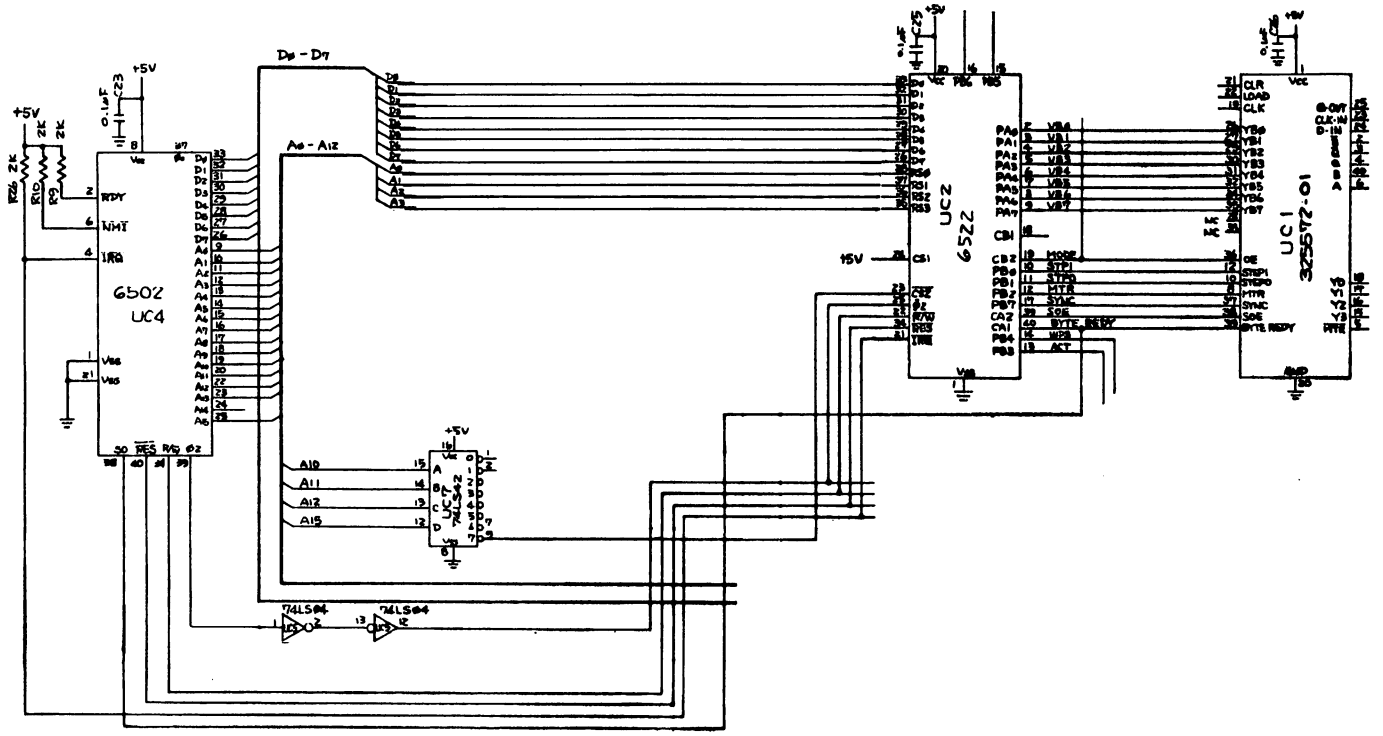
UB3 and UB4 are 8192 x 8 bit ROMS that store the Disk Operating System (DOS). UB3 resides at memory locations $C000-$DFFF. UB4 resides at memory locations $E000-$FFFF. UC5 and UC6 decode the addresses output from the microprocessor when selecting these ROMS.

UB2 is a 2048 x 8 bit RAM. UB2 resides at memory locations $0000-$07FF. This memory is used for processor stack operations, general processor housekeeping, user program storage, and 4 temporary buffer areas. UC5, UC6, and UC7 decode the addresses output from the processor when selecting RAM.



The Serial Interface

UC3 is a 6522 Versatile Interface Adapter (VIA). Two parallel ports, handshake control, programmable timers, and interrupt control are standard features of the VIA. Port B signals (PB0-PB7) control the serial interface driver IC's (UB1 and UA1). CLK and DATA signals are bidirectional signals connected to pins 4 and 5 of P2 and P3. ATN (Attention) is an input on pin 3 of P2 and P3 that is sensed at PB7 and CA1 of UC3 after being inverted by UA1. ATNA (Attention Acknowledge) is an output from PB4 of UC3 which is sensed on the data line pin 5 of P2 and P3 after being exclusively "ored" by UD3 and inverted by UB1. UC3 is selected by UC7 pin 7 going "low" when the proper address is output from the processor. UC3 resides at memory locations $1C00-$1C0F.

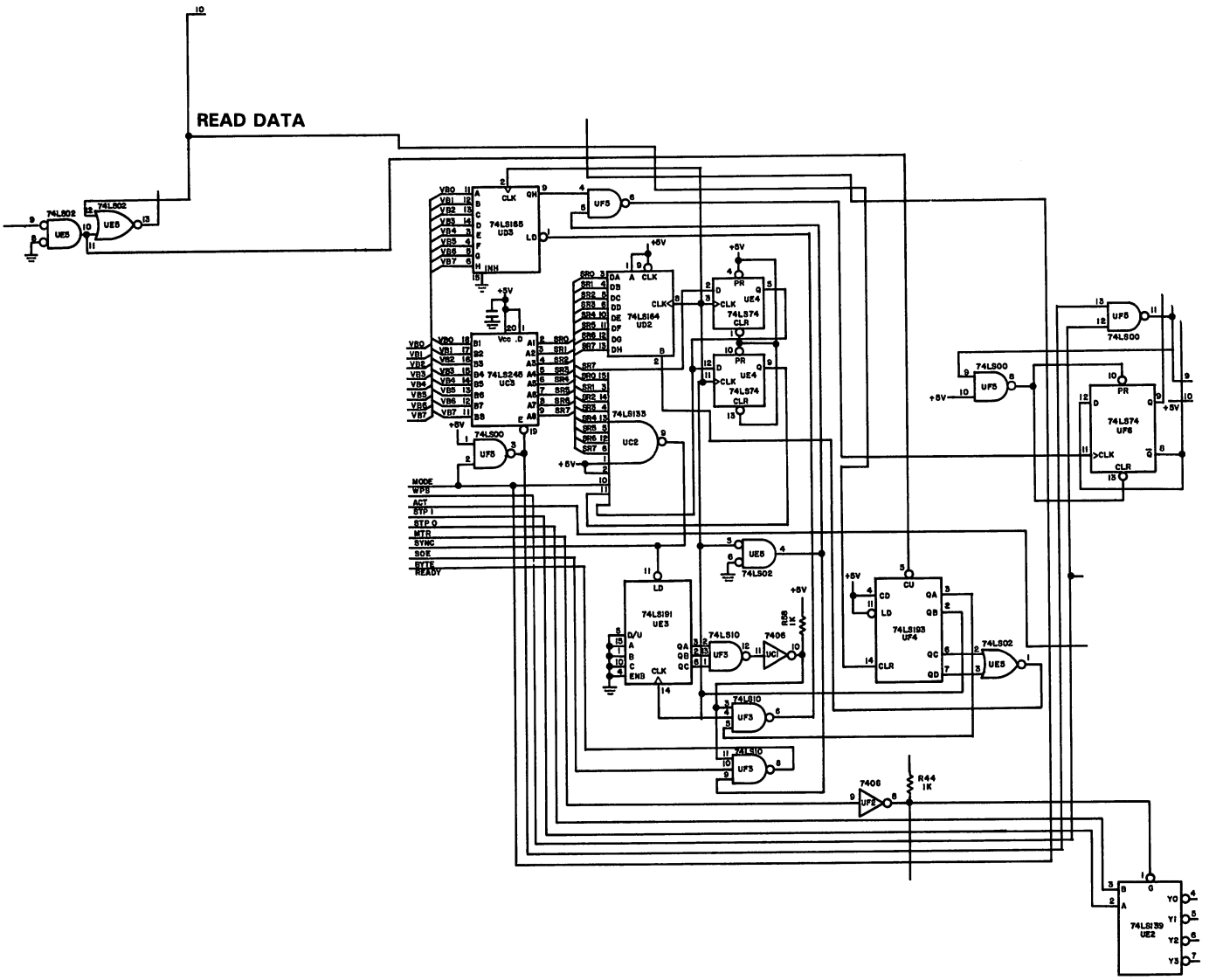


Microprocessor R/W and Motor Control Logic

UC2 is a VIA also. During a write operation the microprocessor passes the data to be recorded to Port A of UC2. The data is then loaded into the PLA parallel port (YB0-YB7). The PLA contains a shift register which converts the parallel data into serial data. The PLA generates signals on pins 2, 3, 4, and 40 which control the write amplifiers during the write operation. During a read operation serial data is received from the read amplifier circuits on D-IN input on pin 24 of the PLA. The PLA shift register converts serial data into parallel data that is latched at the parallel port (YB0-YB7). The microprocessor reads the parallel PLA output by reading Port A of UC2 when BYTE READY on pin 39 goes ''low''.

The stepper motor is controlled by two outputs on port B of UC2 (STP0, and STP1). A binary four count is developed from these two lines, driving the four phases of the stepper motor. The PLA converts STP0 and STP1 into four outputs that represent one of the four states in the count (Y0,Y1,Y2,Y3). The Spindle motor is controlled by the output MTR of UC2. The PLA inverts this signal. It is then passed to the motor speed control pcb.

UC2 pin 14 is an input that monitors the state of the write protect sensor, and pin 13 is an output that controls the activity light (RED LED). UC7 decodes the addresses output from the processor when selecting UC2. UC2 resides at memory locations $1800-$180F.

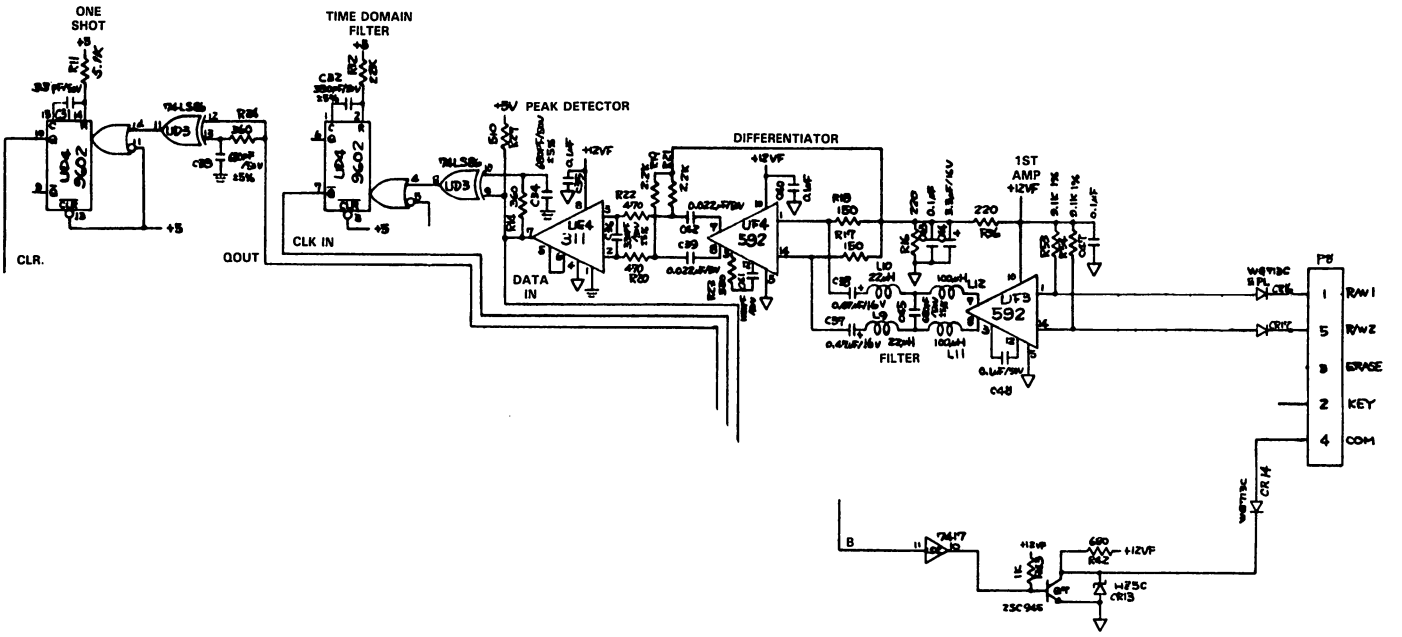


The circuit shown here is from the long board schematic 1540008. This logic was integrated in the PLA (Programmable Logic Array) on the short boards.

Read/Write Control Logic

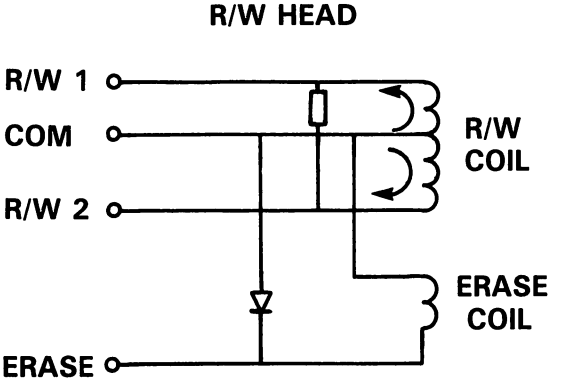
During a write operation, UD3 converts parallel data into serial data. The output on pin 9 is input to 'NAND' gate UF5 pin 4. UF5 outputs the serial data on pin 6 at the clock rate determined by input signal on pin 5. The output clocks the D flip flop UF6. The outputs of UF6, Q and $\overline{Q}$, drive the write amplifiers.

During a read operation, data from the read amplifiers is applied to the CLR input of counter UF4. The outputs, C and D, are shaped by the 'NOR' gate UE5. UE5 outputs the serial data on pin 1, then it is converted to parallel data by UD2. The output of UD2 is latched by UC3. The serial bits are counted by UE3, when 8 bits have been counted, UF3 pin 12 goes "low", UC1 pin 10 goes "high", and UF3 pin 8 goes "low" indicating a byte is ready to be read by the processor. UC2 monitors the parallel output of UD2, when all 8 bits are "1", the output pin 9 goes "low" indicating a sync bit has been read.

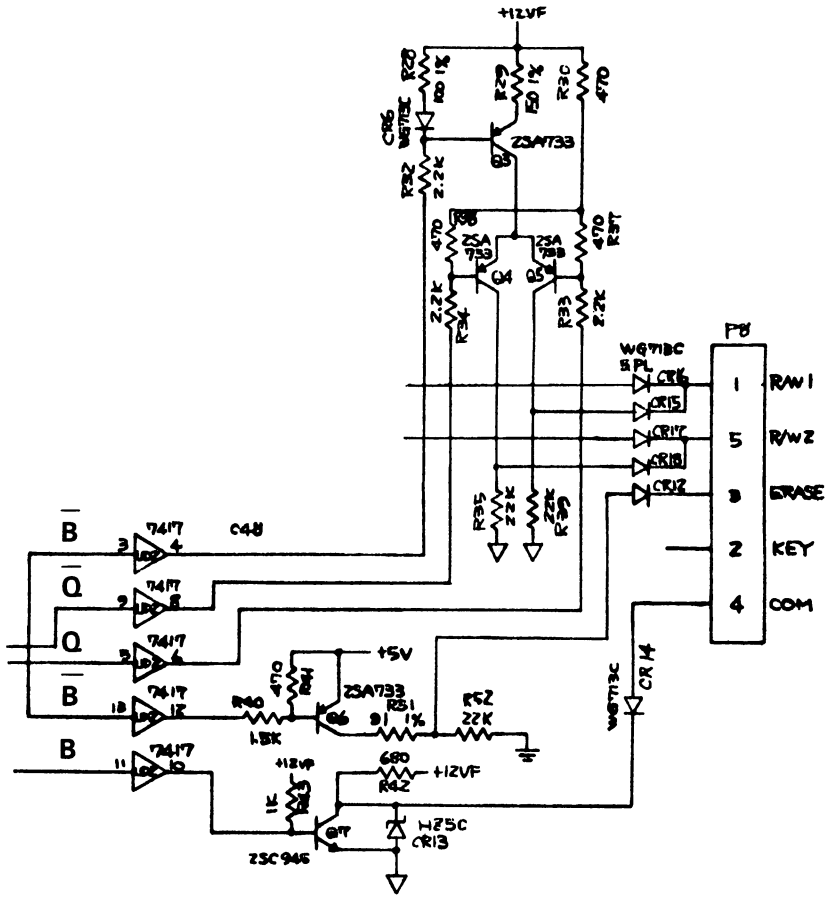


Read Amplifier Circuits

When data is recorded on the disk, a "1" bit is represented on the disk by a change in direction of magnetic flux, caused by a change in direction of current passed through the R/W coil in the R/W head. When a "0" bit is to be recorded, no change in current flow direction occurs, causing the direction of the magnetic flux to remain the same on the disk.



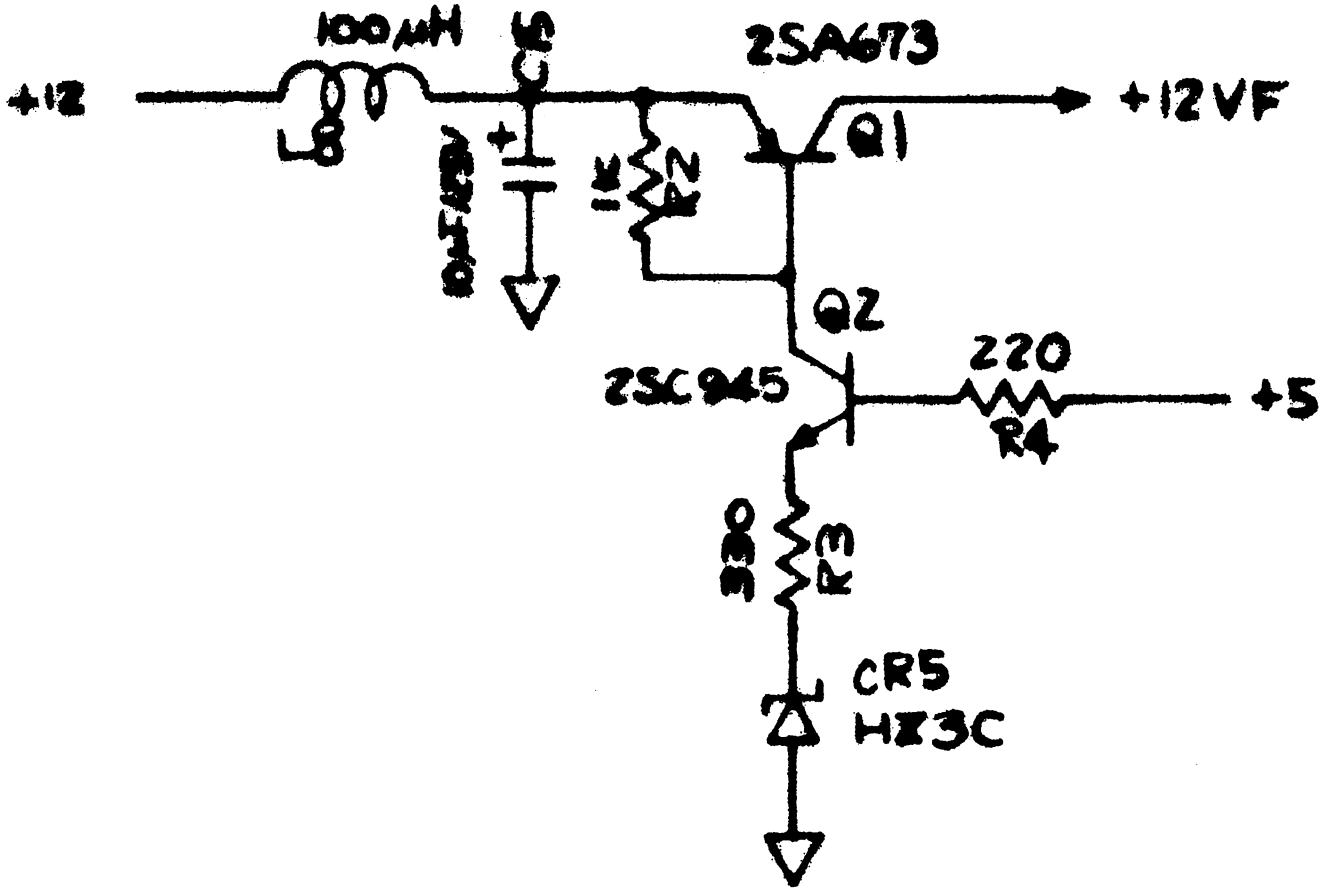
When data is being read from the disk, CEMF is induced into the R/W coil by the magnetic fields on the disk, causing current flow which is detected by the read amplifiers. Current flow through the R/W coil will forward bias either CR16 or CR17, depending on the direction. Q7 and CR14 must be forward biased. The first amplifier UF3, senses this current flow from the R/W coil on one of the inputs and amplifies it. L9, L10, L11, L12 and C45 act as a low pass filter, suppressing noise on the amplified output. UF4 is a differential amplifier which amplifies the difference of the two input signals from the filter section. UE4 is a peak detector. The output of UE4 will pulse "high" when a "1" is read. This signal is the reconstruction of data recorded. The Time Domain Filter, UD4, times out when a "1" bit has been read, so unwanted "1" bits are not added to the actual data. The One Shot UD4 generates the correct data pulse width so the PLA can convert the data to parallel for processor control.



Write Amplifier Circuits

During a write operation, B must be "high". This forward biases Q7 and CR14. If $\overline{B}$ goes "low", Q3 and Q6 become forward biased. If Q goes "low", Q5 and CR15 become forward biased, passing current flow through R/W 1. If $\overline{Q}$ goes "low", Q4 and CR18 become forward biased, passing current flow through R/W 2.

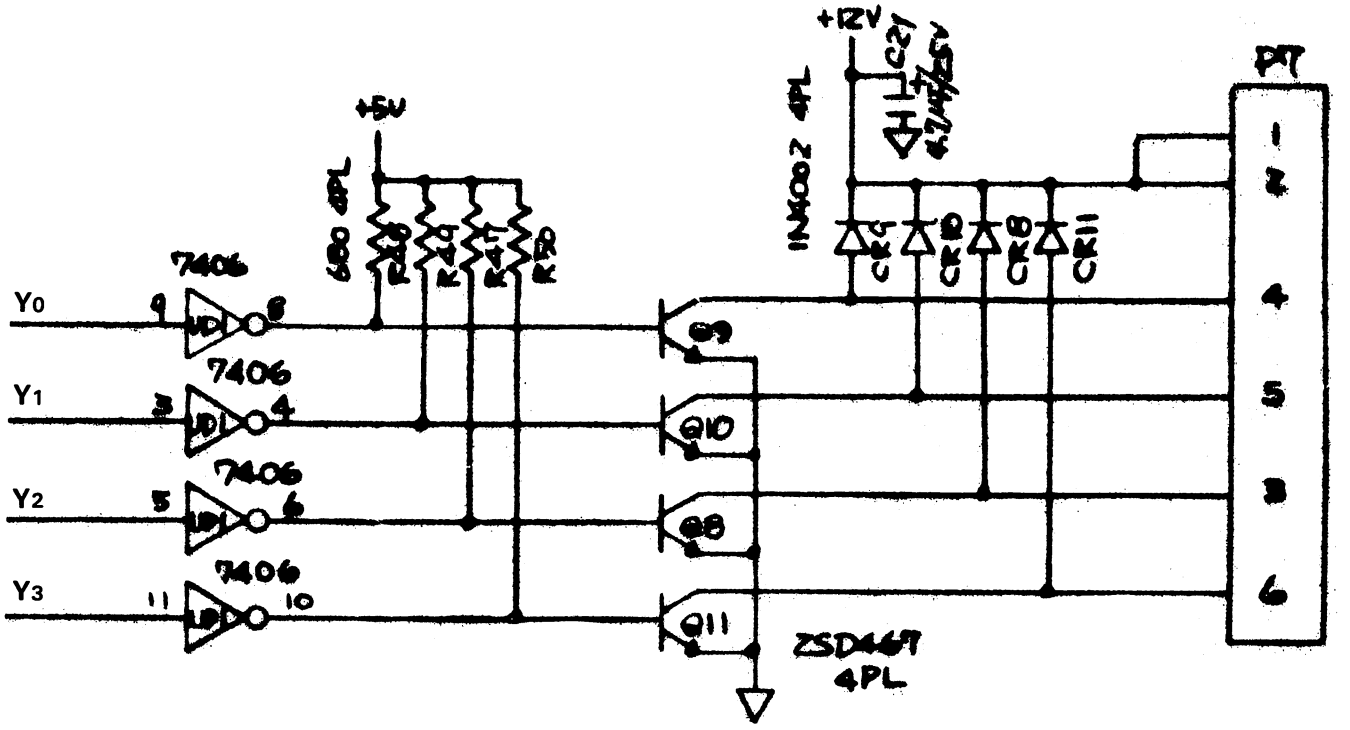
When a write operation occurs, the ERASE coil is energized by forward biasing Q6. This demagnetizes the outer edges of the track, preventing data on one track from bleeding into the next track.



Power Up/Down Write Protection

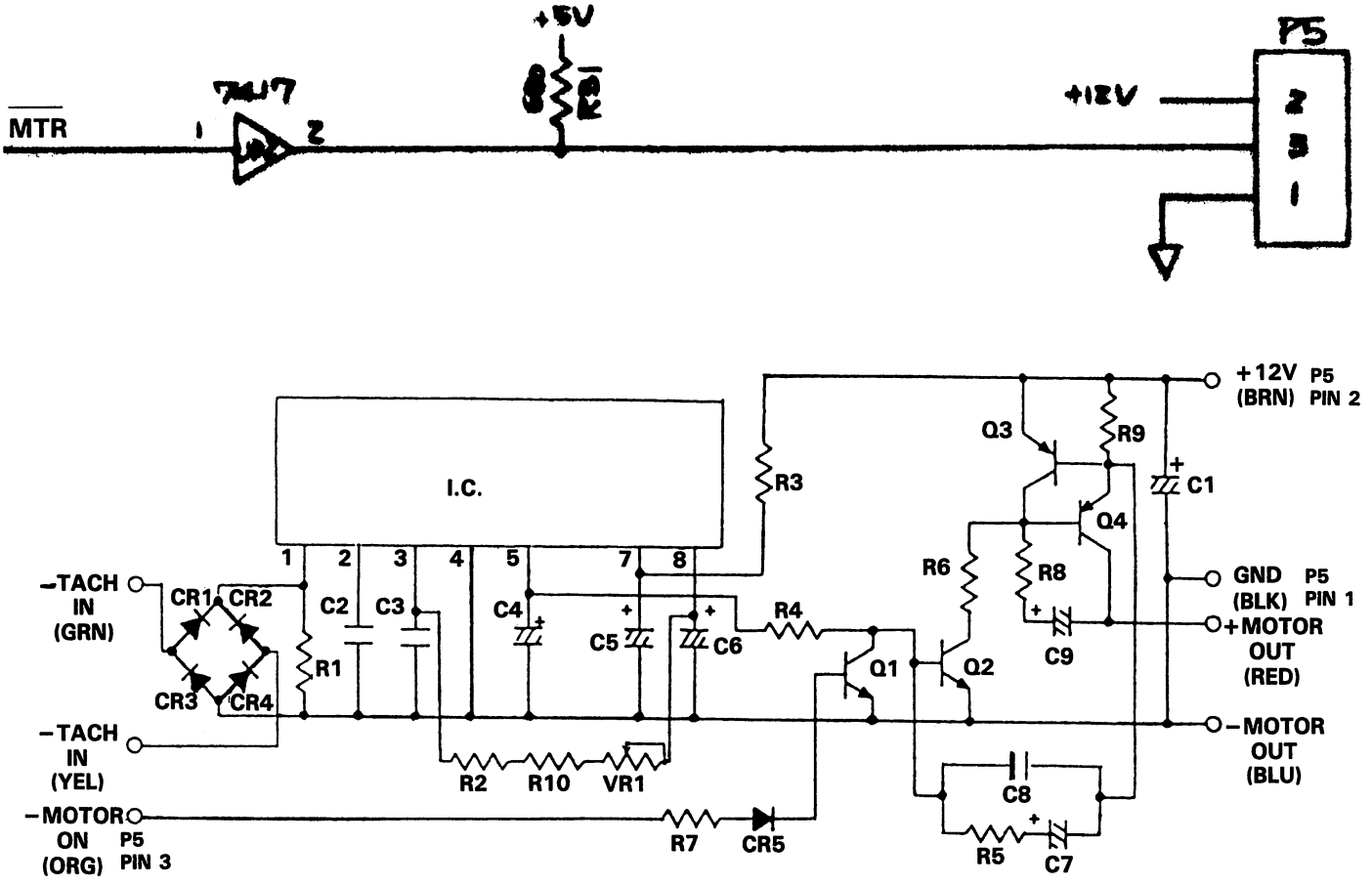
This circuit prevents erroneous data from being written on the disk during power up/down sequences. During a power up, the 12VDC supply is not applied to the R/W coils and amplifier circuits before the processor has control of the logic. During a power down the 12VDC supply is removed from the R/W coils and amplifier circuits before the processor loses control of the logic.

Q1 acts as a series pass transistor, biased to regulate the 12VF output to the R/W coils and Amplifier circuits. Q2 is a feedback amplifier monitoring the 5VDC supply. CR5 develops a precise reference voltage for Q2. L8 and C15 delay the 12VDC supply.



Stepper Motor Control Circuits

Outputs Y0, Y1, Y2, and Y3 from the PLA are inverted by UD1. The outputs of the inverters drive Q8-Q11. The current output from these transistors drive the individual phase coils in the stepper motor and return to the 12VDC supply. CR8-CR11 suppress the CEMF developed by the motor coils.



Spindle Motor Control Circuits

$\overline{\text{MTR}}$ output from the PLA is active "low". This signal is passed, through the current driver UD2, to the motor control PCB. When $\overline{\text{MTR}}$ is "low," Q1 is biased off, and Q2, Q3, and Q4 are biased on, allowing current flow through the spindle motor coil. Attached to the shaft of the spindle motor is an inductive tachometer that generates low level AC voltages, as the motor spins. The output of the tachometer is rectified by CR1-CR4. IC 1 monitors the output of the rectifier and adjusts the bias to Q2, which changes the bias on Q3 and Q4 to regulate motor current for a constant velocity. VR1 is a manual speed adjustment. The speed can be adjusted by watching the 60Hz strobe as the adjustment is made or loading the system test from the diagnostic disc.

The Newtronics Motor Speed PCB is electronically the same as the ALPS Motor Speed PCB, but some of the discrete components have been integrated.

TROUBLESHOOTING GUIDE

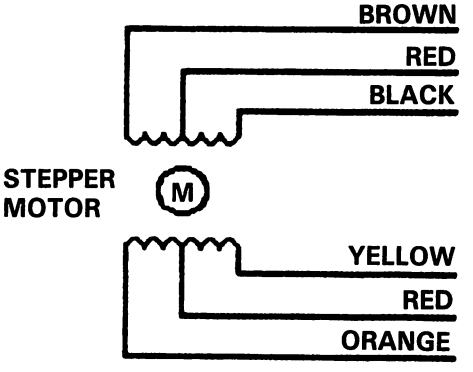
NOTE: Always check for latest ROM/ECO upgrade. If socketed IC is suspected bad, be sure to check socket with ohmmeter.

SYMPTOM:	POSSIBLE SOLUTION:
No LED's on power up.	Is Power cord plugged into wall outlet correctly? Is Power cord plugged into the disk drive correctly? Check line fuse. Check power switch. Check clock on 6502 pin 37. Check +5 and +12 volt lines.
Error LED flashes on power up.	Check all RAM and ROM locations.
Error LED stays on all the time.	Check 6502 microprocessor. Check ROMs.
Drive motor runs continuously and red LED stays on.	Check +12V. Check 6502, logic gates, logic array.
Drive motor runs continuously and red LED stays off.	Check Rom Check drive motor PCB.
Drive motor runs continuously with no red or green LED's.	Check VR2 (5V Regulator). Check Power Transformer.
After the drive warms up the motor runs continuously.	Check 6522s. Check motor control PCB.
Loads programs with red LED flashing.	Check drive speed. Check stepper motor.
Loading is intermittent.	Check ROMs. Check drive alignment.
Does not load when hot or LED flashed 3 times.	Check ROMs.
Searches with LED flashing continuously.	Check ROMs.
Searching with no red LED.	Check 6522s, logic gates, logic array.
Message of 'FILE NOT FOUND' is displayed.	Clean drive head w/alcohol. Check Ø stop adjustment. Check alignment.
Drive fails to read.	Check the 311, 9602, and 592s. There are two +12 volt sources for stepper output and read circuit, make sure both are good.

TROUBLESHOOTING GUIDE (Continued)

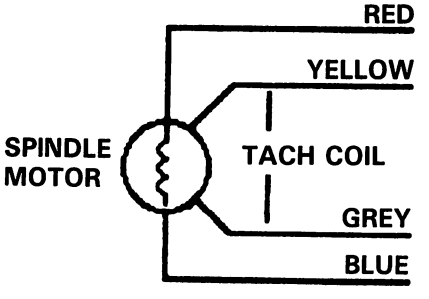
SYMPTOM:	POSSIBLE SOLUTION:
Fails to format disk.	Check components related to connector P7. Check 6522s. Check logic array.
Stepper Motor does not step forward.	Check 6502, 6522s, logic array.
Drive speed will not stabilize.	Check DC motor.
Will not save when the drive heats up.	Check 6502 microprocessor.
Locks-up when loading.	Check serial port components. Check ROM.
Fails the performance test and displays a 21 read error.	Check test diskette. Check Drive Motor.
Fails the performance test and displays a 27 read error.	Check stop adjust.
Passes performance test to track 18 then displays 21 read errors.	Check read/write head.
Passes the performance test but will not load certain programs.	Check stepper motor.

RESISTANCE CHECKS



32 OHMS END TO CENTERTAP

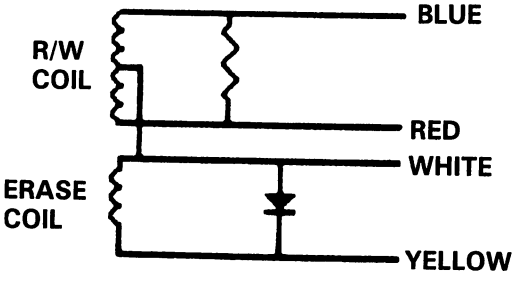
64 OHMS END TO END



MOTOR COIL = 17 OHMS

TACH COIL = 175 OHMS AT REST

TACH COIL = 135 – 190 OHMS IN MOTION



R/W END TO END = 32.4 OHMS
R/W END TO CENTERTAP = 16.3 OHMS
ERASE COIL END TO END = 10.5 OHMS

CASEWORK/ACCESSORY PARTS LIST

1540/1541	TOP CASE (IVORY)	C 1540014-01
1540/41	BOTTOM CASE (IVORY)	C 1540015-00
1541	TOP CASE (BROWN)	C 1540014-03
1541	BOTTOM CASE (BROWN)	C 1540015-01
SHIELD COVER		1540013-01
LED ASSEMBLY		1540003
SELF ADHESIVE FOOT		C 950150-02
1540 NAMEPLATE		C 1540016-01
1541 NAMEPLATE		C 1540052-01
POWER CORD ASSEMBLY		C 903508-04
6 PIN DIN CABLE		C 1515001-01
USER'S MANUAL		C 1540031-03
DEMO DISKETTE		C 1540024-01

NOTE: All 1540 Disk Drives were manufactured prior to any changes to the board and used the Alps drive exclusively.

1541 MODEL IDENTIFICATION

PCB Assy # 1540008-01
- Schematic # 1540001
- Original "Long" Board
- Has 4 discreet 2114 RAMs
- ALPS Drive only

PCB Assy # 1540048
- Schematic # 1540049
- Referred to as the CR board
- Changed to 2048 x 8 bit RAM pkg.
- A 40 pin Gate Array is used

-01
- Alps Drive

-03
- Newtronics Drive

PCB Assy # 250442-01
- Schematic # 251748
- Termed the 1541 A
- Just one jumper change to accommodate both types of drive

PCB Assy # 250446-01
- Schematic # 251748 (See Notes)
- Termed the 1541 A-2
- Just one jumper change to accommodate both types of drive

NOTE: The simplest way to identify which drive you have is by the door assembly. Alps is made with a "push down" door and Newtronics has a "flipper" type door.

DEVICE NUMBER CHANGE

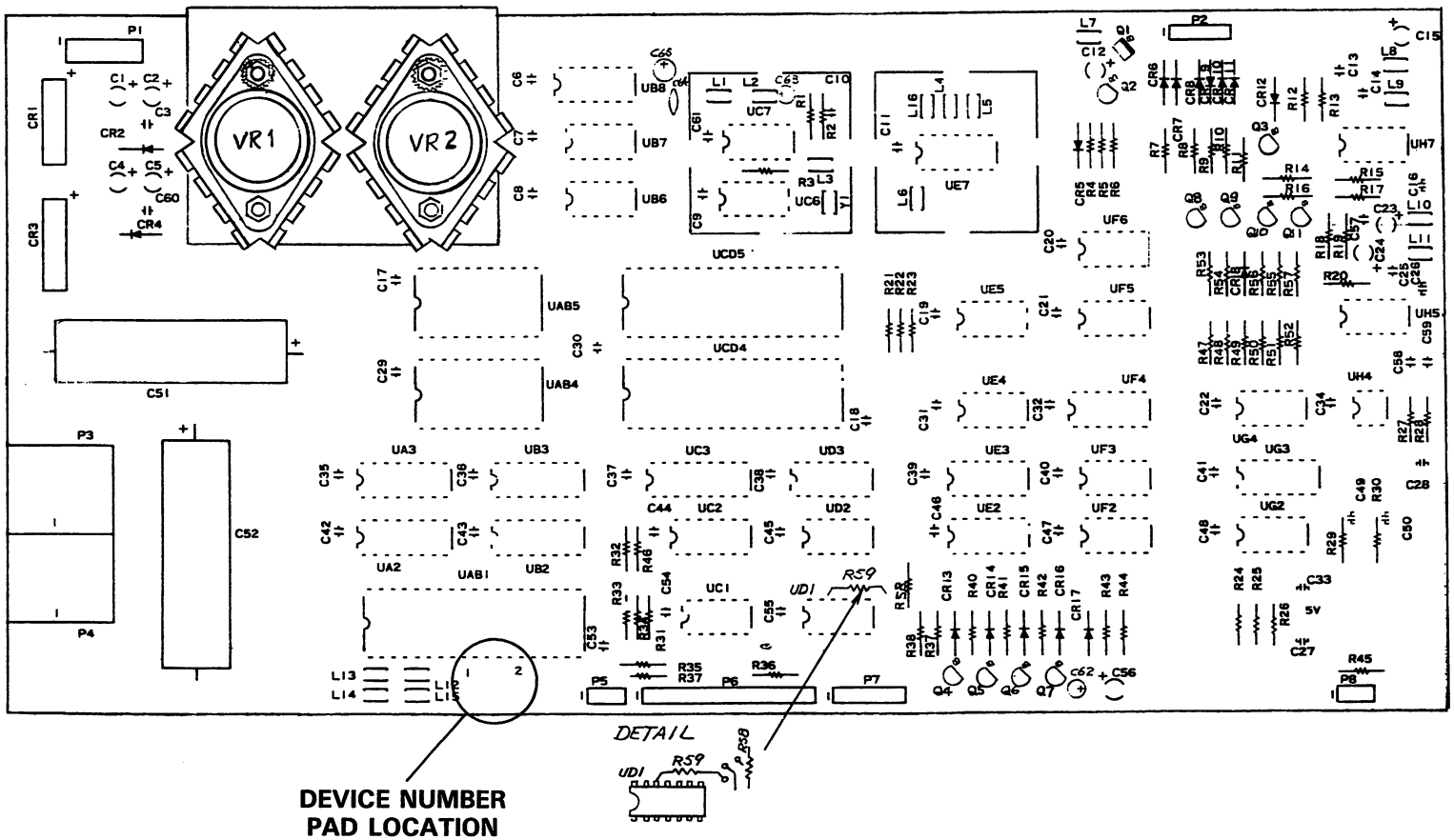
The 1540 and 1541 drives are shipped from the factory set for device # 8. The channel can be hardware altered to # 9, 10, or 11 by two methods:

1) Refer to appropriate board layout drawing for the location of the pads provided for this purpose. The device change pads must be CUT to alter the channel number and re-soldered if another change is needed later.

2) The preferred method to alter the device number is to lift certain pins of the 6522 chip. The I.C. should always be socketed, so removal of the chip is simple. Once removed, the proper pin can be carefully bent to eliminate it from the circuit. If another change is needed, simply remove the I.C. and re-install with the pin back in place.

PCB ASSY #	LOCATION	DEVICE #	LIFT PIN
1540008	UAB1	9	15
1540048,251748	UC3	10	16
and 251834	UC3	11	15 and 16

PCB ASSEMBLY #1540001
BOARD LAYOUT



PARTS LIST
PCB ASSEMBLY #1540001

PLEASE NOTE:

Commodore part numbers are provided for reference only and do not indicate the availability of parts from Commodore. Industry standard parts (Resistors, Capacitors, Connectors) should be secured locally. Approved cross-references for TTL chips, Transistors, etc. will be available in manual form through the Service Department in November of 1984. Unique or non-standard parts will be stocked by Commodore and are indicated on the parts list by a "C".

INTEGRATED CIRCUITS			
UAB1	6522 VIA	C 901437-01	
UAB2	2114 RAM	901471-01	
UAB3	2114 RAM	901471-01	
UAB4	ROM $C000-$DFFF	C 325302-01	
UAB5	ROM $E000-$FFFF (1540)	C 325303-01	
UAB5	ROM $E000-$FFFF (1541)	C 901229-07	
UB2	2114 RAM	901471-01	
UB3	2114 RAM	901471-01	
UCD4	6522 VIA	C 901437-01	
UCD5	6502 CPU	C 901435-01	
UG3	9602	901510-01	
UH4	LM311	901523-04	
UH5	NE 592	901523-08	
UH7	NE 592	901523-08	

TTL			
UB6	74LS04	901521-02	
UB7	74LS00	901521-01	
UB8	74LS42	901521-17	
UC1	74LS14	901521-30	
UC2	74LS133	901521-15	
UC3	74LS245	901521-45	
UC6	74177	901522-03	sub:
	74LS197	901521-54	
UC7	7402	901522-32	
UD1	7406	901522-06	
UD2	74LS164	901521-28	
UD3	74LS165	901521-12	
UE2	74LS139	901521-18	
UE3	74LS191	901521-40	
UE4	74LS74	901521-06	
UE5	74LS02	901521-21	
UE7	74LS193	901521-26	
UF2	7406	901522-06	
UF3	74LS10	901521-24	
UF4	74LS193	901521-26	
UF5	74LS00	901521-01	
UF6	74LS74	901521-06	
UG2	74LS86	901521-32	
UG4	7417	901522-01	sub:
	7407	901522-30	

TRANSISTORS			
Q1	2SA673 PNP	902720-01	
Q2, 3	2SC945 NPN	902671-01	sub:
	2SC1815 NPN	902693-01	
Q4, 7	2SD467 NPN	902679-01	sub:
	2SC2120 NPN	902682-01	
Q8-11	2SA733 PNP	902717-01	sub:
	2SA1015 PNP	902744-01	

DIODES			
CR1	Bridge, 1.5A, 50V	900756-01	
CR2	Rectifier, IN4002	900750-02	
CR3	Bridge, 4A, 50V	900755-02	
CR4	Rectifier, IN4002	900750-02	
CR5	Zener, 3.3V, 500mW, +/-5%		
	HZ3C-2	325505-01	sub:
	HZ4A-1	325505-02	sub:
	IN5226B	900948-06	
CR6-11	Signal, WG713C	900850-05	sub:
	IN4148	900850-01	
CR12	Zener, 5.1V, 500mW, +/-5%		
	HZ5C-2	325506-01	sub:
	IN5231	900948-11	
CR13-16	Rectifier, IN4002	900750-02	
CR17, 18	Signal, WG713C	900850-05	Sub:
	IN4148	900850-01	

RESISTORS – All Values are in ohms- 1/4 W 5% unless noted otherwise.

R1, 2	330
R3	47
R4	220
R5	330
R6	1K
R7	22K
R8	91, Metal Oxide 1/4W, 1%
R9	680
R10	22K
R11	1K
R12, 13	9.1K, Metal Oxide 1/4W, 1%
R14, 15	2.2K
R16, 17	220
R18, 19	150
R20	330
R21-23	2K
R24	510
R25	360
R26	5.1K
R27, 28	470
R29	22K
R30	360
R31-34	1K
R35, 36	100
R37	330
R38	2K
R39-42	680
R43	6.8K
R44	1K
R45	220
R46	100K

PARTS LIST PCB ASSEMBLY #1540001 (Continued)

C - Indicates Commodore Stocked Part Number

RESISTORS (Continued)
– All values are in ohms- 1/4 W 5% unless noted otherwise.

R47	470
R48	1.5K
R49	100, Metal Oxide 1/4W, 1%
R50	470
R51, 52	2.2K
R53	22K
R54	150, Metal Oxide 1/4W, 1%
R55	470
R56	2.2K
R57	470
R58	1K
R59	220

CAPACITORS

C1	Electrolytic	1μF,	25V
C2	Electrolytic	47μF,	16V
C3	Ceramic	.1μF,	50V
C4	Electrolytic	1μF,	25V
C5	Electrolytic	47μF,	16V
C6-9	Ceramic	.1μF,	50V
C10	Ceramic	68pF,	50V
C11	Ceramic	.1μF,	50V
C12	Tantalium	10μF,	25V
C13, 14	Ceramic	.1μF,	50V
C15	Tantalium	.47μF,	16V +/–20%
C16	Ceramic	680 pF,	50V +/–5%
C17-22	Ceramic	.1μF,	50V
C23	Tantalium	3.3μF,	25V
C24	Tantalium	.47μF,	16V +/–20%
C25	Ceramic	.1μF,	50V
C26	Ceramic	1000pF,	50V
C27	Ceramic	680pF,	50V +/–5%
C28	Ceramic	330pF,	50V +/–5%
C29-32	Ceramic	.1μF,	50V
C33	Ceramic	33pF,	50V
C34-48	Ceramic	.1μF,	50V
C49	Ceramic	330pF,	50V +/–5%
C50	Ceramic	680pF,	50V +/–5%

CAPACITORS (Continued)

C51	Electrolytic	6800μF,	25V
C52	Electrolytic	10000μF,	16V
C53-55	Ceramic	.1μF,	50V
C56	Electrolytic	100μF,	16V
C57	Ceramic	.1μF,	50V
C58, 59	Ceramic	.022μF,	16V
C60, 61	Ceramic	.1μF,	50V
C62	Tantalium	4.7μF,	25V
C63	Tantalium	1μF,	35V
C64	Ceramic	.033μF,	25V
C65	Electrolytic	220μF,	25V

MISCELLANEOUS

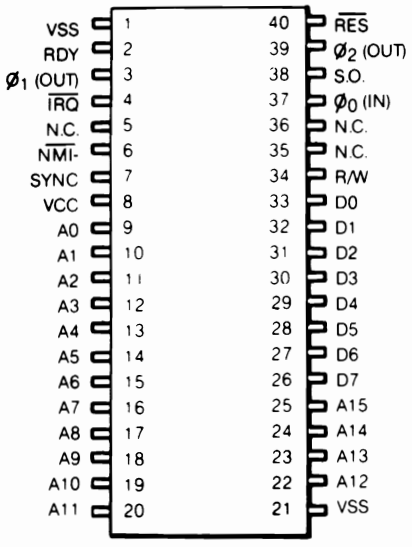
L1	Coil Inductor 2.2μH
L2-6	Ferrite Bead (2743005112)
L7	Coil Inductor 100μH
L8	Coil Inductor 22μH
L9, 10	Coil Inductor 100μH
L11	Coil Inductor 22μH
L12-16	Ferrite Bead (2743005112)
VR1	Voltage Reg 12V, 1.5A (LM340K-12 TO-3)
VR2	Voltage Reg 5V, 1.2A (LM340K-5 TO-3) Sub: 5V, 3A (LM323)
Y1	Crystal 16MHz 900556-02
	Shield Box 4022048-01
	Shield Cap 4022047-01

CONNECTORS

P1	Header Assy, 3.96 Pitch, 4Pin	(Mole 5271-04A)
P2, 3	6 Pin Din, (Hoshidenki TSC4460-01-101	C 903361-01
P4, 5	Header Assy, 2.5 Pitch, 3Pin	(Molex 3022-03A)
P6	Header Assy, 2.5 Pitch, 15Pin	(Molex 3022-15A)
P7	Header Assy, 2.5 Pitch, 6Pin	(Molex 3022-06A)
P8	Header Assy, 2.5 Pitch, 4Pin	(Molex 5048-04AG)

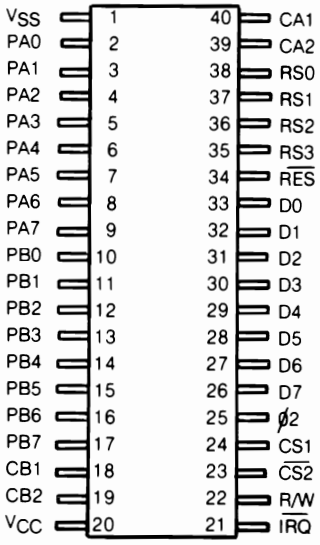
PIN CONFIGURATIONS:

6502

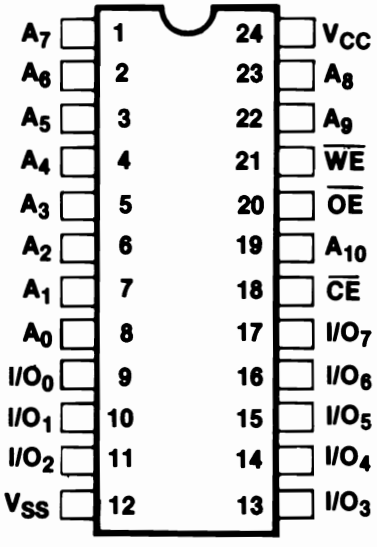


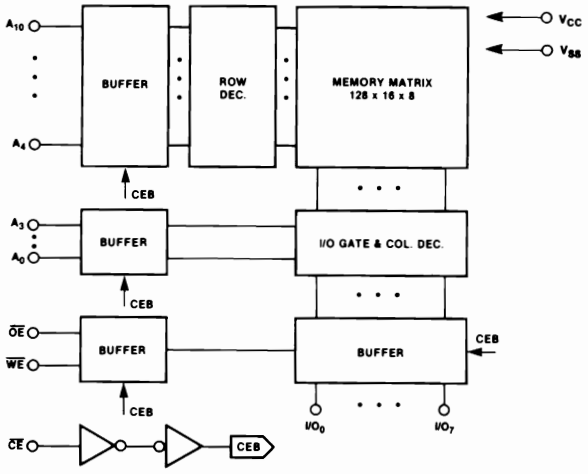
901435-01
Microprocessor

6522



901437-01
Versatile Interface Adapter (VIA)

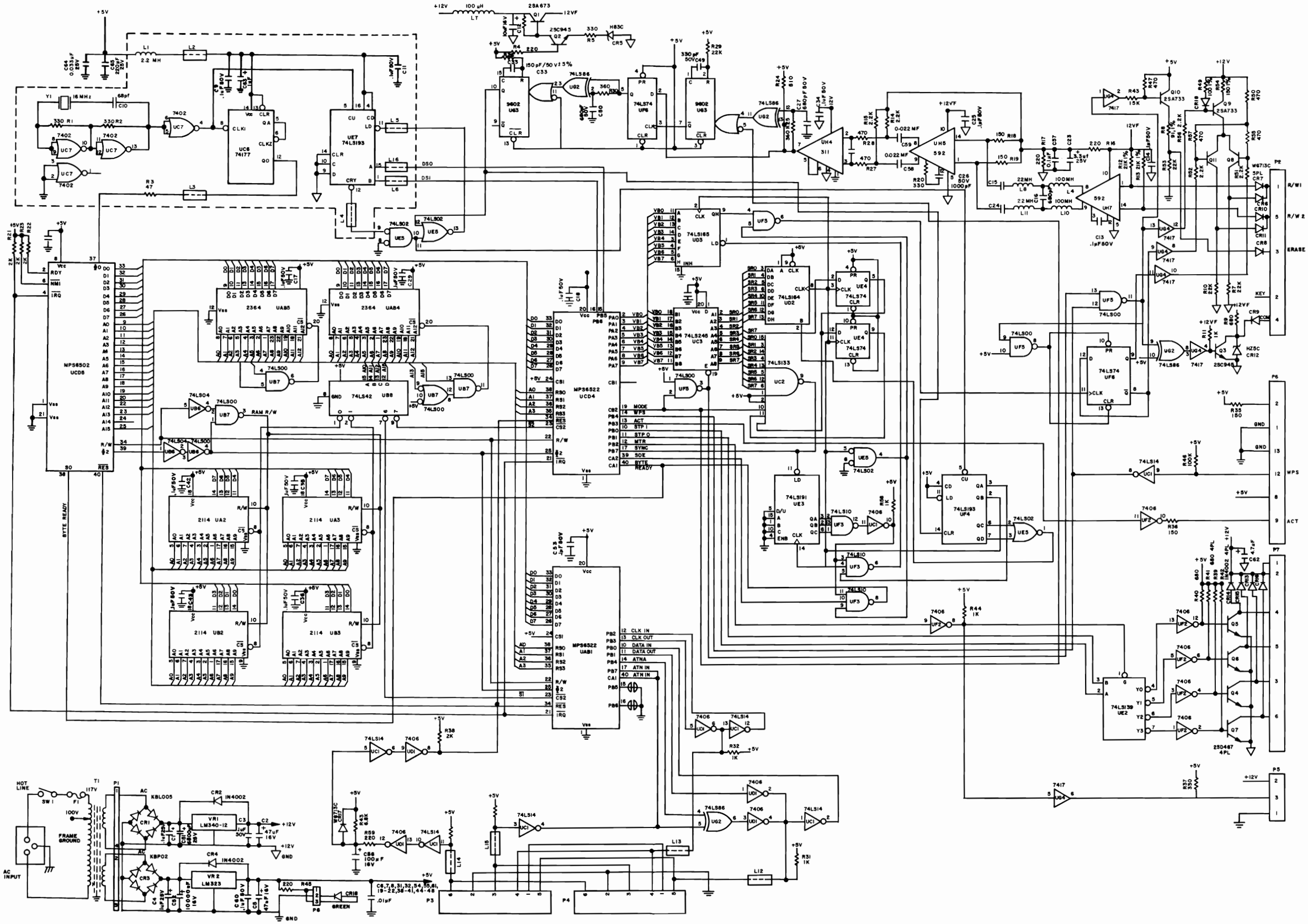




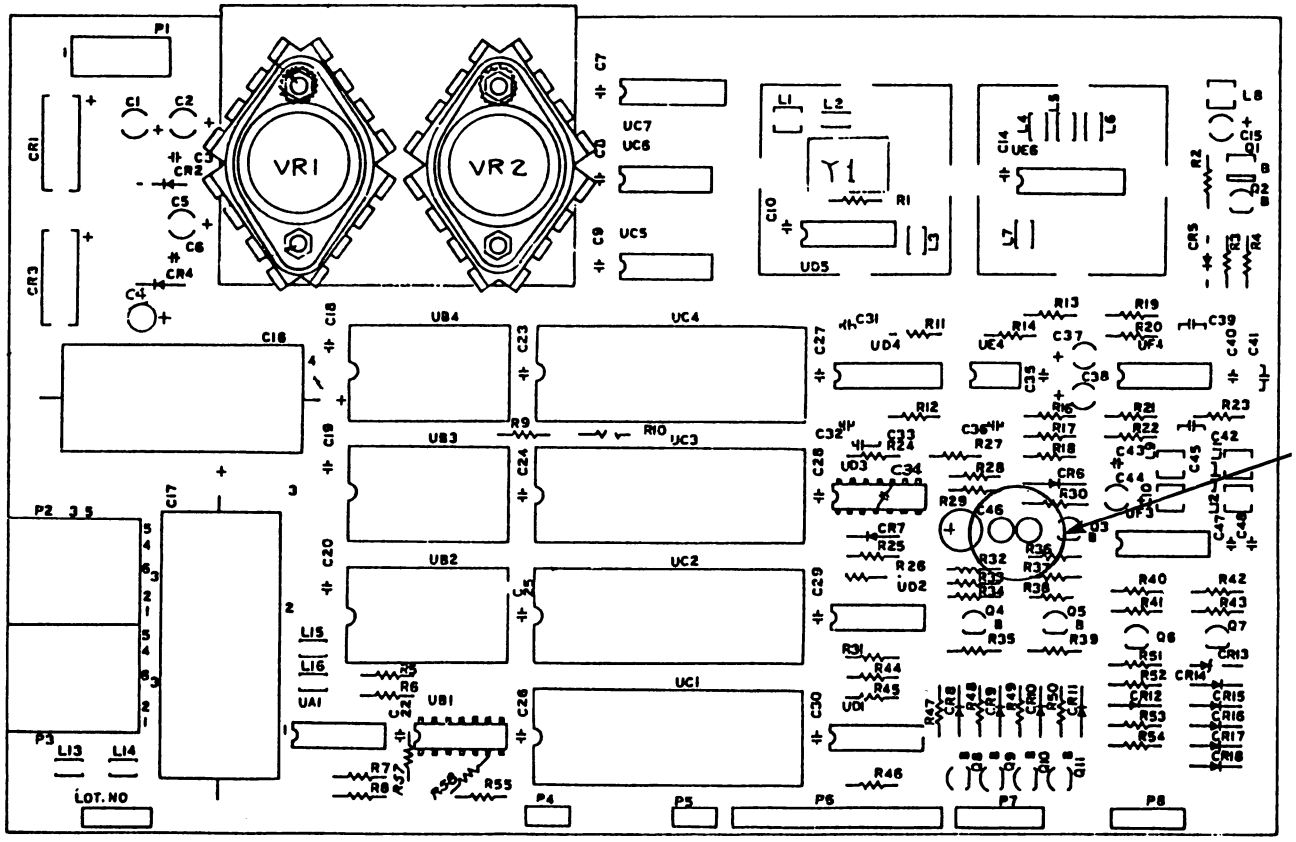
2048 X 8 STATIC RAM

Approved Replacements	
Mitsubishi	M58725P
Toshiba	TMM2016P
Hitachi	HM6116LP-4/AP-20

SCHEMATIC #1540008



PCB ASSY #1540048
BOARD LAYOUT



PARTS LIST
PCB ASSEMBLY #1540048

PLEASE NOTE:
Commodore part numbers are provided for reference only and do not indicate the availability of parts from Commodore. Industry standard parts (Resistors, Capacitors, Connectors) should be secured locally. Approved cross-references for TTL chips, Transistors, etc. will be available in manual form through the Service Department in November of 1984. Unique or non-standard parts will be stocked by Commodore and are indicated on the parts list by a "C".

INTEGRATED CIRCUITS			
UB2	TMM2016P RAM	325502-03	sub:
	M58725P RAM	325502-01	sub:
	HM6116P4	325502-08	
UB3	ROM $C000-$DFFF	C 325302-01	
UB4	ROM $E000-$FFFF	C 901229-05	
UC1	GATE ARRAY	C 325572-01	
UC2	6522 VIA	C 901437-01	
UC3	6522 VIA	C 901437-01	
UC4	6502 CPU	C 901435-01	
UD4	9602	901510-01	
UE4	LM311	901523-04	
UF3	NE 592	901523-08	
UF4	NE 592	901523-08	
TTL			
UA1	74LS14	901521-30	
UB1	7406	901522-06	sub:
	7707	251749-01	
UC5	74LS04	901521-02	sub:
	7713	251749-02	sub:
	74LS14	901521-30	sub:
	7414	901522-19	
UC6	74LS00	901521-01	
UC7	74LS42	901521-17	
UD1	7406	901522-06	
UD2	7417	901522-01	sub:
	7407	901522-30	
UD3	74LS86	901521-32	
UD5	74LS197	901521-54	sub:
	74177	901522-03	
UE6	74LS193	901521-26	
TRANSISTORS			
Q1	2SA673 PNP	902720-01	
Q2	2SC945 NPN	902671-01	sub:
	2SC1815 NPN	902693-01	
Q3-6	2SA733 PNP	902717-01	sub:
	2SA1015 PNP	902744-01	
Q7	2SC945 NPN	902671-01	sub:
	2SC1815 NPN	902693-01	
Q8-11	2SD467 NPN	902679-01	sub:
	2SC2120 NPN	902682-01	

DIODES		
CR1	Bridge, 1.5A, 50V	900756-01
CR2	Rectifier, IN4002	900750-02
CR3	Bridge, 1.5A, 50V	900756-01
CR4	Rectifier, IN4002	900750-02
CR5	Zener, 3.3V, 500mW, +/-5%	
	HZ3C-2	325505-01 sub:
	HZ4A-1	325505-02 sub:
	IN5226B	900948-06
CR6, 7	Signal, WG713C	900850-05 sub:
	IN4148	900850-01
CR8-11	Rectifier, IN4002	900750-02
CR12	Signal, WG713C	900850-05 sub:
	IN4148	900850-01
CR13	Zener, 5.1V, 500mW, +/-5%	
	HZ5C-2	325506-01 sub:
	IN5231	900948-11
CR14-18	Signal, WG713C	900850-05 Sub:
	IN4148	900850-01

RESISTORS — All Values are in ohms- 1/4 W 5% unless noted otherwise.	
R1	47
R2	1K
R3	330
R4	220
R5-8	1K
R9, 10	2K
R11	5.1K
R12	22K
R14	360
R16	220
R17, 18	150
R19	2.2K
R20	470
R21	2.2K
R22	470
R23	330
R24	360
R25	6.8K
R26	2K
R27	510
R28	100 @ 1%
R29	150 @ 1% (ALPS)
	137 @ 1% (NEWTRONICS)
R30	470
R31	680
R32-34	2.2K
R35	22K
R36	220
R37, 38	470
R39	22K

PARTS LIST PCB ASSEMBLY #1540048 (Continued)

C - Indicates Commodore Stocked Part Number

RESISTORS (Continued)
– All Values are in ohms- 1/4 W 5% unless noted otherwise.

R40	1.5K
R41	470
R42	680
R43	1K
R44	100K
R45, 46	150
R47-50	680
R51	91 @ 1% (ALPS)
	56 @ 1% (NEWTRONICS)
R52	22K
R53, 54	9.1K @ 1%
R55	220
R57	220
R58	2K

CAPACITORS

C1	Electrolytic	1μF, 25V
C2	Electrolytic	47 μF, 16V
C3	Ceramic	.1μF, 50V
C4	Electrolytic	1μF, 25V
C5	Electrolytic	47μF, 16V
C6-10	Ceramic	.1μF, 50V
C11	Tantalium	1μF, 35V
C12	Ceramic	.033μF, 25V
C13	Electrolytic	220μF, 10V
C14	Ceramic	.1μF, 50V
C15	Tantalium	10μF, 25V
C16	Electrolytic	4700μF, 16V
C17	Electrolytic	6800μF, 25V
C18-20	Ceramic	.1μF, 50V
C21	Tantalium	4.7μF, 25V
C22-30	Ceramic	.1μF, 50V
C31	Ceramic	33pF, 50V +/-5%
C32	Ceramic	330pF, 50V +/-5%
C33, 34	Ceramic	680pF, 50V +/-5%
C35	Ceramic	.1μF, 50V
C36	Ceramic	330pF, 50V +/-5%
C37-38	Tantalium	.47μF, 16V

CAPACITORS (Continued)

C39	Ceramic	.022μF, 16V
C40	Ceramic	.1μF, 50V
C41	Ceramic	1000pF, 50V
C42	Ceramic	.022μF, 16V
C43	Ceramic	.1μF, 50V
C44	Tantalium	3.3μF, 25V
C45	Ceramic	680pF, 50V +/-5%
C46	Electrolytic	100μF, 16V
C47,48	Ceramic	.1μF, 50V

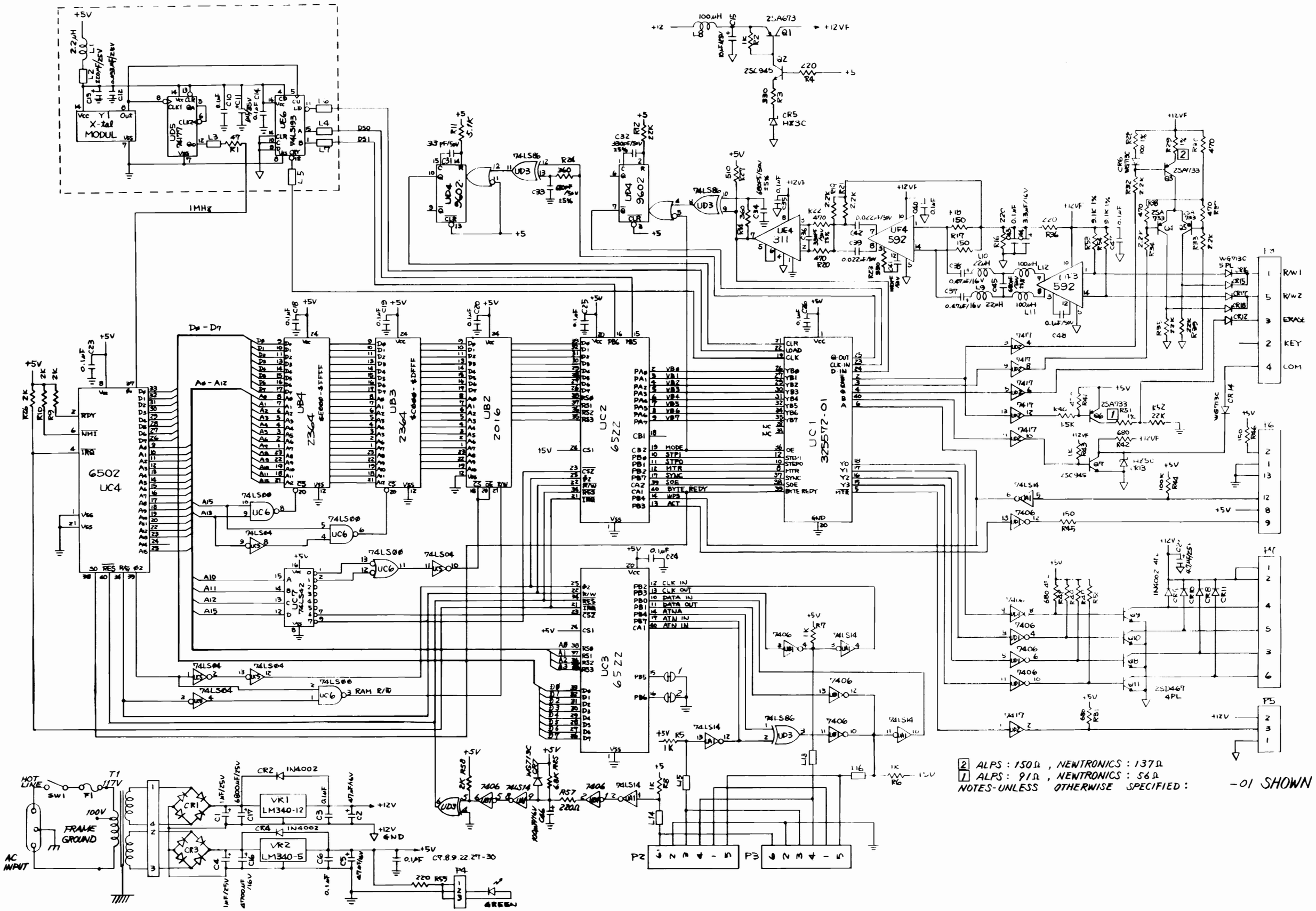
MISCELLANEOUS

L1	Coil Inductor 2.2μH
L2-7	Ferrite Bead (2743005112)
L8	Coil Inductor 100μH
L9,10	Coil Inductor 22μH
L11,12	Coil Inductor 100μH
L13-16	Ferrite Bead
VR1	Voltage Reg 12V, 1.5A (LM340K-12 TO-3)
VR2	Voltage Reg 5V, 1.2A (LM340K-5 TO-3) Sub: 5V, 3A (LM323)
Y1	Crystal Module 16MHz 50ppm (NDK, Tyocom) Sub: 16MHz 100ppm (NDK, Tyocom, Kyocera)
	Shield Box C 4022048-01
	Shield Cap C 4022047-01

CONNECTORS

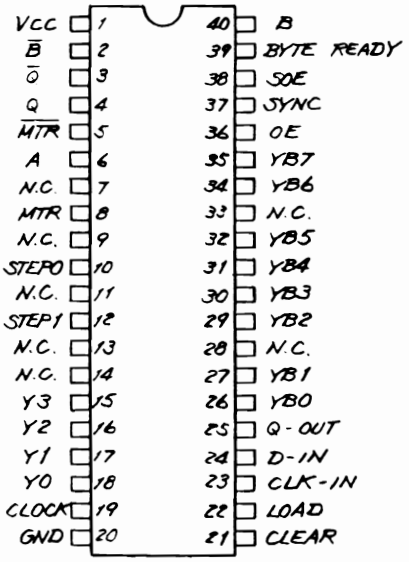
P1	Header Assy, 3.96 Pitch, 4Pin	(Molex 5271-04A)
P2, 3	6 Pin Din,	C 903361-01
P4, 5	Header Assy, 2.5 Pitch, 3Pin	(Molex 3022-03A)
P6	Header Assy, 2.5 Pitch, 15Pin	(Molex 3022-15A)
P7	Header Assy, 2.5 Pitch, 6Pin	(Molex 3022-06A)
P8	Header Assy, 2.5 Pitch, 4Pin	(Molex 5048-04AG)

SCHEMATIC #1540049



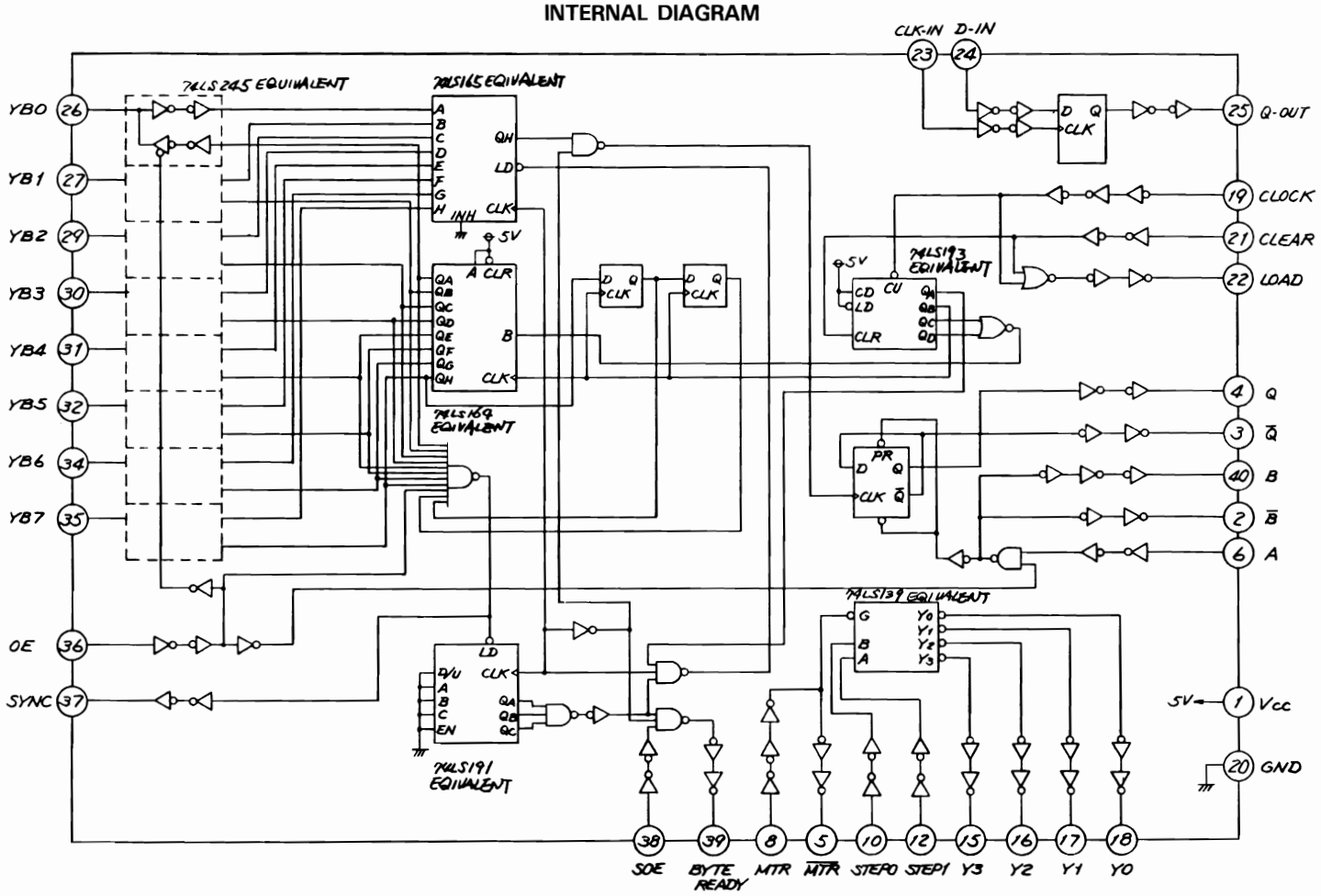
2 ALPS : 150Ω , NEWTRONICS : 137Ω
1 ALPS : 91Ω , NEWTRONICS : 56Ω
NOTES-UNLESS OTHERWISE SPECIFIED :

-01 SHOWN

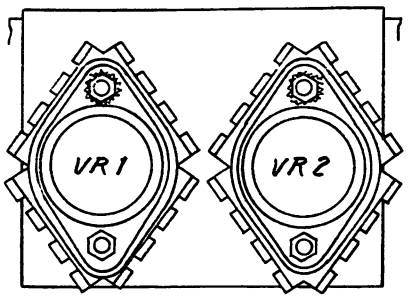


PN 325572
GATE ARRAY FOR FLOPPY DISK DRIVE

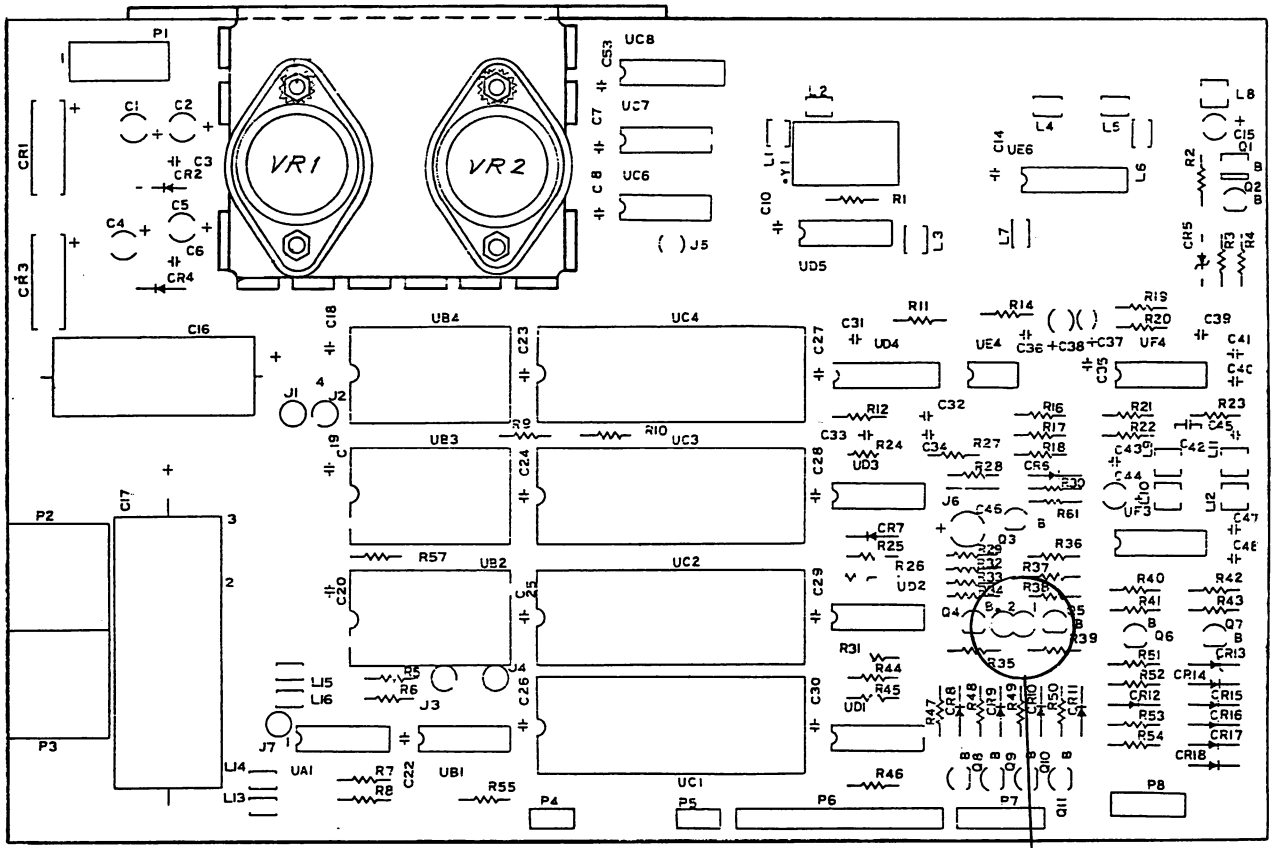
INTERNAL DIAGRAM



PCB ASSEMBLY #250442/46
BOARD LAYOUT



SUBSTITUTE HEATSINK



PARTS LIST
PCB ASSEMBLY #250442/46

PLEASE NOTE:

Commodore part numbers are provided for reference only and do not indicate the availability of parts from Commodore. Industry standard parts (Resistors, Capacitors, Connectors) should be secured locally. Approved cross-references for TTL chips, Transistors, etc. will be available in manual form through the Service Department in November of 1984. Unique or non-standard parts will be stocked by Commodore and are indicated on the parts list by a "C".

INTEGRATED CIRCUITS				
UB2	TMM2016P RAM		325502-03	sub:
	M58725P RAM		325502-01	sub:
	HM6116P4		325502-08	
UB3	ROM $C000-$DFFF		C 325302-01	
UB4	ROM $E000-$FFFF		C 901229-05	
UC1	GATE ARRAY		C 325572-01	
UC2	6522 VIA		C 901437-01	
UC3	6522 VIA		C 901437-01	
UC4	6502 CPU		C 901435-01	
UD4	9602	(250442)	901510-01	sub:
	74LS123	(250446)	901521-49	
UE4	LM311		901523-04	
UF3	NE 592		901523-08	
UF4	NE 592		901523-08	

TTL			
UA1	74LS14	901521-30	
UB1	7406	901522-06	sub:
	74LS06	901521-73	
UC5	74LS04	901521-02	sub:
	74LS14	901521-30	sub:
	7414	901522-19	
UC7	74LS00	901521-01	
UC8	74LS42	901521-17	
UD1	7406	901522-06	sub:
	74LS06	901521-73	
UD2	7417	901522-01	sub:
	7407	901522-30	
UD3	74LS86	901521-32	
UD5	74LS197	901521-54	sub:
	74177	901522-03	
UE6	74LS193	901521-26	

TRANSISTORS				
Q1	2SA673	PNP	902720-01	
Q2	2SC945	NPN	902671-01	sub:
	2SC1815	NPN	902693-01	
Q3-6	2SA733	PNP	902717-01	sub:
	2SA1015	PNP	902744-01	
Q7	2SC945	NPN	902671-01	sub:
	2SC1815	NPN	902693-01	
Q8-11	2SD467	NPN	902679-01	sub:
	2SC2120	NPN	902682-01	

DIODES			
CR1	Bridge, 1.5A, 50V	900756-01	
CR2	Rectifier, IN4002	900750-02	
CR3	Bridge, 1.5A, 50V	900756-01	
CR4	Rectifier, IN4002	900750-02	
CR5	Zener, 3.3V, 500mW, +/-5%		
	HZ3C-2	325505-01	sub:
	HZ4A-1	325505-02	sub:
	IN5226B	900948-06	

DIODES (Continued)			
CR6, 7	Signal, WG713C	900850-05	sub:
	IN4148	900850-01	
CR8-11	Rectifier, IN4002	900750-02	
CR12	Signal, WG713C	900850-05	sub:
	IN4148	900850-01	
CR13	Zener, 5.1V, 500mW, +/-5%		
	HZ5C-2	325506-01	sub:
	IN5231	900948-11	
CR14-18	Signal, WG713C	900850-05	Sub:
	IN4148	900850-01	

RESISTORS – All values are in ohms- 1/4 W 5% unless noted otherwise.

R1	47	
R2	1K	
R3	330	
R4	220	
R5-8	1K	
R9, 10	2K	
R11	5.1K	
R12	22K	(250442)
	15K	
R14	360	(250446)
R16	220	
R17, 18	150	
R19	2.2K	
R20	470	
R21	2.2K	
R22	470	
R23	330	
R24	360	
R25	6.8K	
R26	2K	
R27	510	
R28	100 @ 1%	
R29	137 @ 1%	
R30	470	
R31	680	
R32-34	2.2K	
R35	22K	
R36	220	
R37, 38	470	
R39	22K	
R40	1.5K	
R41	470	
R42	680	
R43	1K	
R44	100K	
R45, 46	150	
R47-50	680	
R51	56 @ 1%	
R52	22K	
R53, 54	10K	
R55	220	
R57	220	
R61	13 @ 1%	

PARTS LIST PCB ASSEMBLY #250442/46 (Continued)

C - Indicates Commodore Stocked Part Number

CAPACITORS			
C1	Electrolytic	1μF, 25V	
C2	Electrolytic	47μF, 16V	
C3	Ceramic	.1μF, 50V	
C4	Electrolytic	1μF, 25V	
C5	Electrolytic	47μF, 16V	
C6-10	Ceramic	.1μF, 50V	
C11	Tantalium	1μF, 35V	
C12	Ceramic	.033μF, 25V	
C13	Electrolytic	220μF, 10V	
C14	Ceramic	.1μF, 50V	
C15	Tantalium	10μF, 25V	
C16	Electrolytic	4700μF, 16V	
C17	Electrolytic	6800μF, 25V	
C18-20	Ceramic	.1μF, 50V	
C21	Tantalium	4.7μF, 25V	
C22-30	Ceramic	.1μF, 50V	
C31	Ceramic	33pF, 50V	+/-5%
C32	Ceramic	330pF, 50V	+/-5%
C33,34	Ceramic	680pF, 50V	+/-5%
C35	Ceramic	.1μF, 50V	
C36	Ceramic	330pF, 50V	+/-5%
C37,38	Tantalium	.47μF, 16V	
C39	Ceramic	.022μF, 16V	
C40	Ceramic	.1μF, 50V	
C41	Ceramic	1000pF, 50V	
C42	Ceramic	.022μF, 16V	
C43	Ceramic	.1μF, 50V	
C44	Tantalium	3.3μF, 25V	
C45	Ceramic	680pF, 50V	+/-5%
C46	Electrolytic	100μF, 16V	
C47,48	Ceramic	.1μF, 50V	

MISCELLANEOUS	
L1	Coil Inductor 2.2μH
L2-7	Ferrite Bead (2743005112)
L8	Coil Inductor 100μH
L9,10	Coil Inductor 22μH
L11,12	Coil Inductor 100μH
VR1	Voltage Reg 12V, 1.5A (LM340K-12 TO-3)
VR2	Voltage Reg 5V, 1.2A (LM340K-5 TO-3) Sub: 5V, 3A (LM323)
Y1	Crystal Module 16MHz 50ppm (NDK, Tyocom) Sub: 16MHz 100ppm (NDK, Tyocom, Kyocera)

CONNECTORS			
P1	Header Assy, 3.96 Pitch,	4Pin	(Molex 5271-04A)
P2, 3	6 Pin Din,		C 903361-01
P4, 5	Header Assy, 2.5 Pitch,	3Pin	(Molex 3022-03A)
P6	Header Assy, 2.5 Pitch,	15Pin	(Molex 3022-15A)
P7	Header Assy, 2.5 Pitch,	6Pin	(Molex 3022-06A)
P8	Header Assy, 2.5 Pitch,	4Pin	(Molex 5048-04AG)

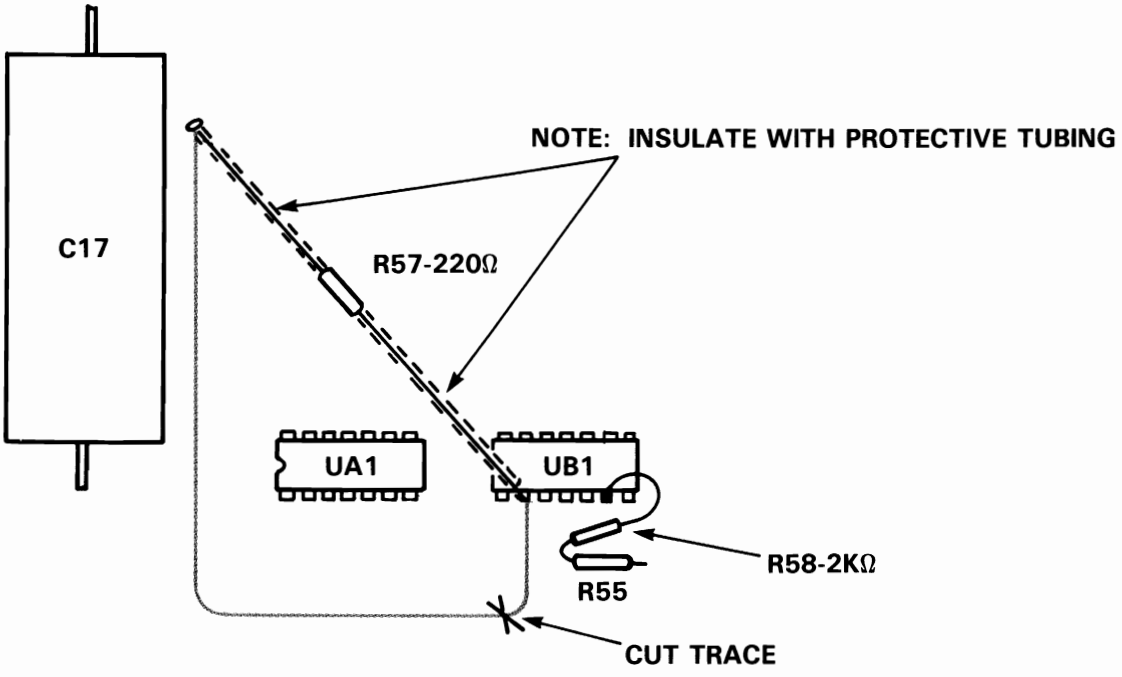
UPGRADE NOTES

PCB Assembly # 1540048 (Schematic 1540049) requires an upgrade to the reset circuit. The upgrade consists of:

1) COMPONENT CHANGES:

R25	Change To	6.8K ohm,	1/4 W, +/−5%
R57	Add	220 ohm,	1/4 W, +/−5%
R58	Add	2K ohm,	1/4 W, +/−5%

2) CUT circuit trace near UA1 (See diagram)



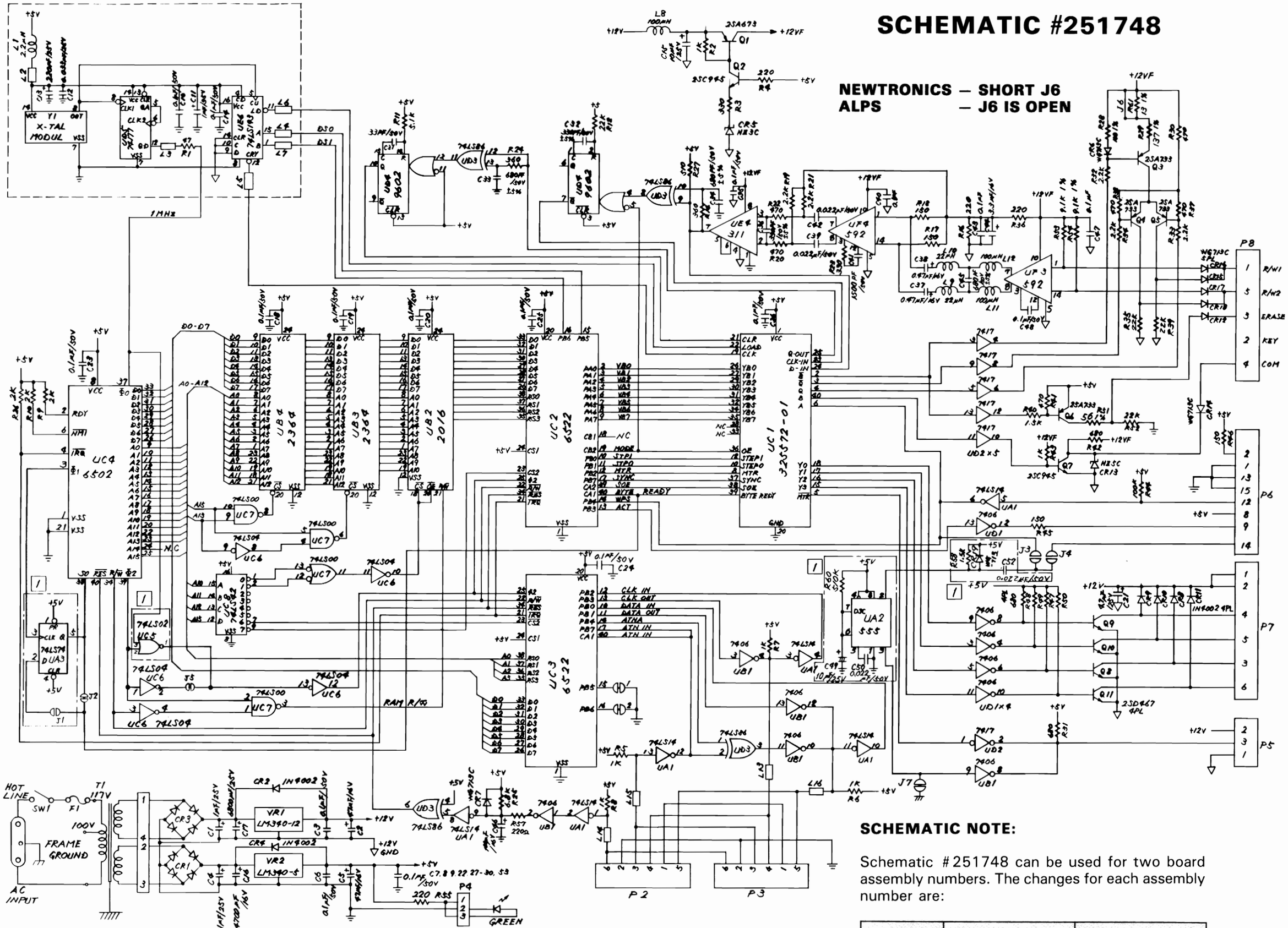
3) INSTALL JUMPER WIRES:

BETWEEN: UA1 pin 8 and UB1 pin 5
UA1 pin 9 and CR7 Anode
UB1 pin 6 and UD3 pin 5 on BACK of board

4) CUT circuit trace between CR7 Anode and UD3 pin 5 on BACK of board.

SCHEMATIC #251748

NEWTRONICS — SHORT J6
ALPS — J6 IS OPEN



SCHEMATIC NOTE:

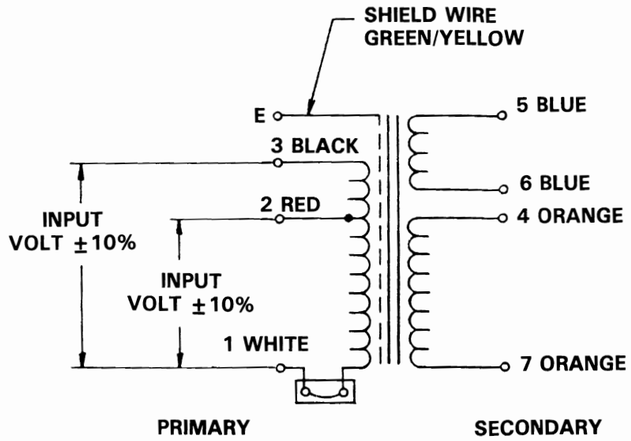
Schematic #251748 can be used for two board assembly numbers. The changes for each assembly number are:

Component	PCB Assy #250442	PCB Assy #250446
UD4	9602	74LS123
R12	22K	15K
C31	33pF	Eliminated

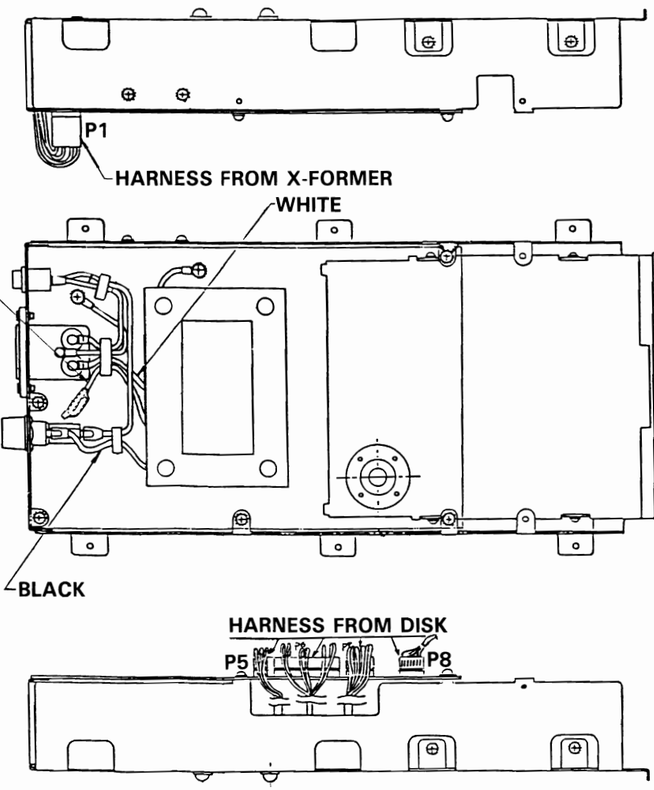
PCB Assembly #250442 is shown here.

1540/1541 POWER SUPPLY ASSEMBLY PARTS LIST

FUSE HOLDER	903614-01
ROCKER SWITCH	904509-01
POWER CNNCT FILTER	903467-03 sub: 325552-01
FUSE, SLOW BLO, 250V, 1.0A	903556-16
POWER TRANSFORMER	1540009-02



TRANSFORMER



ASSEMBLY DRAWING

ALPS DRIVE ASSEMBLIES 1540/1541

PARTS LIST

32551901 Alps Drive (Black)

32551902 Alps Drive (Brown)

① 31410001 ALP DOOR/HUB ASSEMBLY
- 1-Door Assy w/Spring
- 2-Hub/Collet Assy
- 3-Arm Support Assy

② 31410101 ALP LEFT DISK GUIDE ASSEMBLY
- 1-Diskette Guide
- 2-LED Assy w/Harness
- 3-Write Protect Assy

③ 31410201 ALP RIGHT DISK GUIDE

④ 31410301 ALP FRONT BEZEL (Black)

31410302 ALP FRONT BEZEL (Brown)

⑤ 31410401 ALP R/W HEAD ASSEMBLY
- 1-R/W Head
- 2-Load Arm w/Pad
- 3-Metal Band

31410501 ALP STEPPER MOTOR ASSEMBLY
- 1-Stepper Motor w/Harness
- 2-Stepper Pulley

⑥ 31410601 ALP D.C. MOTOR

⑦ 31410701 ALP MOTOR CONTROL PCB ASSEMBLY
- 1-Motor Control PCB
- 2-Harness Assy

⑧ 31410801 ALP TENSION PULLEY ASSEMBLY
- 1-Pulley Wheel w/Spring
- 2-Plastic Housing

⑨ 31410901 ALP HOUSING/SPINDLE ASSEMBLY
- 1-Housing Base
- 2-Spindle Assy
- 3-L/R Guide Shafts

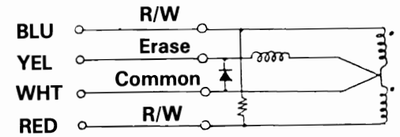
31411001 ALP DRIVE BELT

⑩ 31411101 ALP EJECT ASSEMBLY
- 1-Eject Plate
- 2-Eject Spring

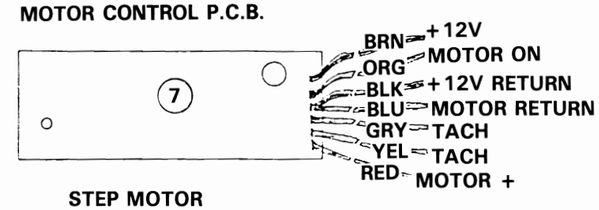
31411201 ALP HARDWARE
- 1-Assorted Screws
- 2-Zero Stop Tab

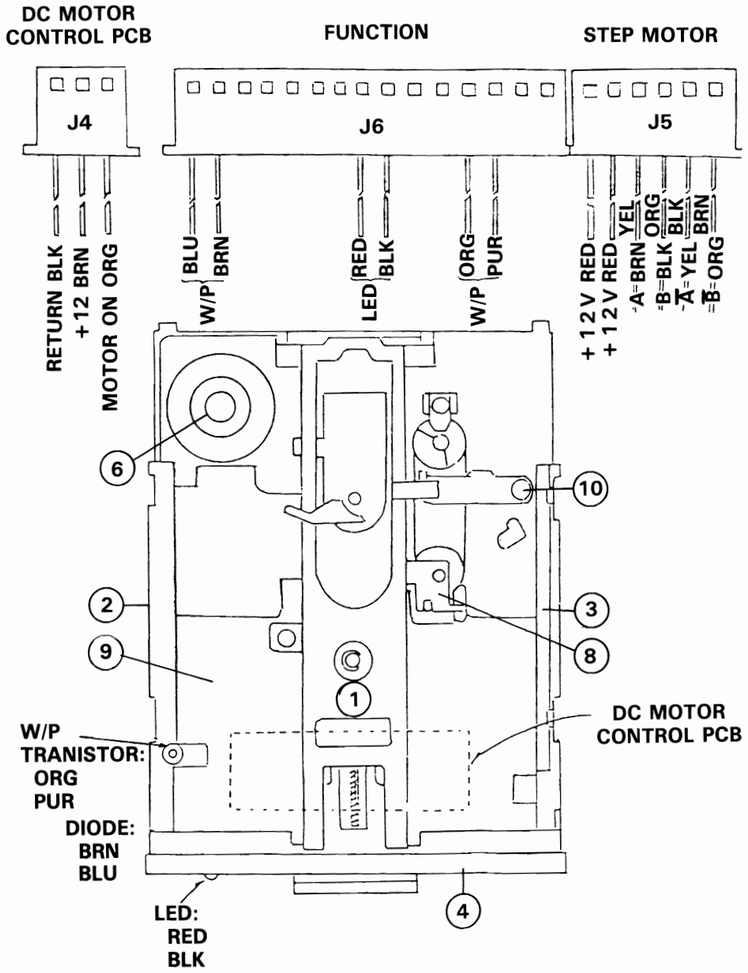
31417401 UNIV Replacement Load Pad

READ/WRITE HEAD ASSEMBLY

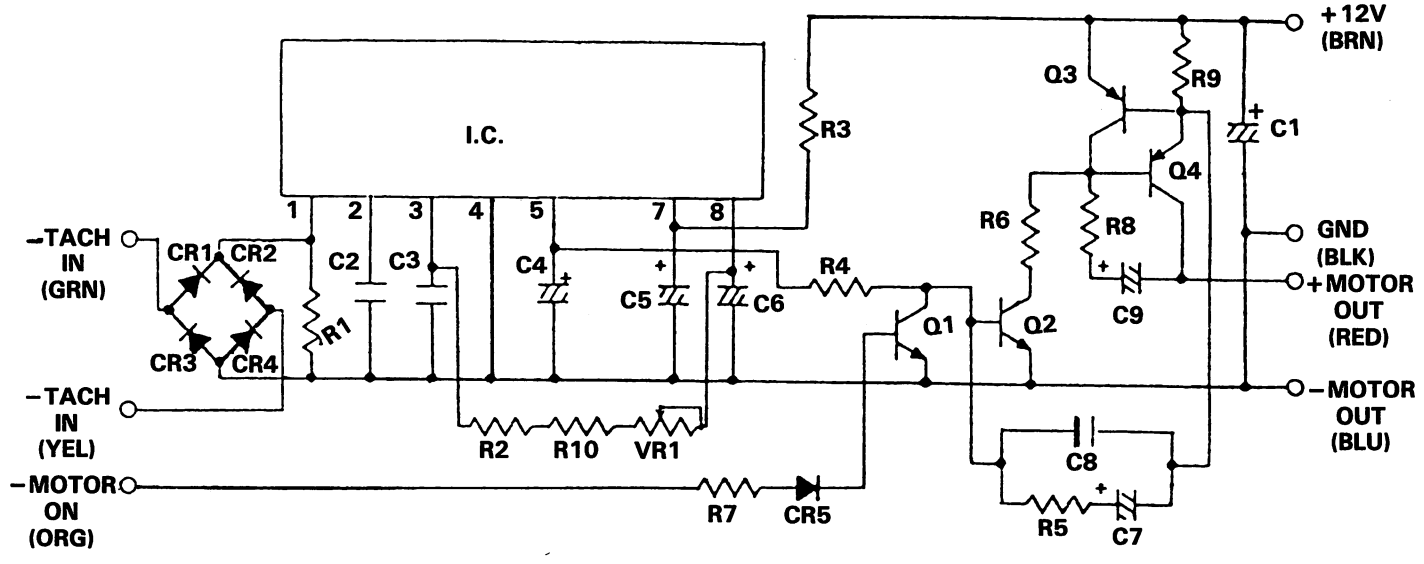


MOTOR CONTROL P.C.B.





ALPS MOTOR CONTROL BOARD SCHEMATIC



SYMBOL	DESCRIPTION		
I.C.	Sony CX-065B	R6	Resistor, 820Ω, 1/4W
Q1	Transistor 2SC2785	R8	Resistor, 150Ω, 1/4W
Q2	Transistor 2SC2785	R9	Resistor, 0.68Ω, 2W
Q3	Transistor 2SA1175	R10	Resistor, 5.1kμ, 1/8W
Q4	Transistor B703-Q36E	VR1	Variable Resistor, 20kΩ
CR1,2,3,4,5	Diode IN4148	C1,5,6	Capacitor, Electrolytic, 10μF, 35V
R1,7	Resistor, 1kΩ, 1/4W	C2	Capacitor, 0.0047μF, 50V
R2	Resistor, 68kΩ, 1/4W	C3	Capacitor, 0.033μF, 50V
R3	Resistor, 220Ω, 1/4W	C4,9	Capacitor, Tantalium, 0.47μF, 35V
R4	Resistor, 3.3kΩ, 1/4W	C7	Capacitor, Tantalium, 2.2μF, 16V
R5	Resistor, 2.7kΩ, 1/4W	C8	Capacitor, 0.068μF, 50V

NEWTRONICS DRIVE ASSEMBLY
1541

PARTS LIST

#251643-01 NEWTRONICS DRIVE (Brown)

#251643-02 NEWTRONICS DRIVE (Dk. Grey)

① 314120-01 NWT DOOR/LATCH ASSEMBLY
- 1-Top Plate w/Latch Spring & Cam
- 2-Latch Knob w/Allen Screws

② 314121-01 NWT HUB FRAME ASSEMBLY
- 1-Hub/Collet Assy
- 2-Hub Frame

③ 314122-01 NWT FRONT BEZEL ASSEMBLY
- 1-Front Bezel w/LED & Harness
- 2-Write Protect Assy

④ 314123-01 NWT R/W HEAD ASSEMBLY
- 1-R/W Head
- 2-Load Arm w/Pad
- 3-Metal Band

314124-01 NWT STEPPER MOTOR ASSEMBLY
- 1-Stepper Motor w/Harness
- 2-Stepper Pulley

⑤ 314125-01 NWT D.C. MOTOR

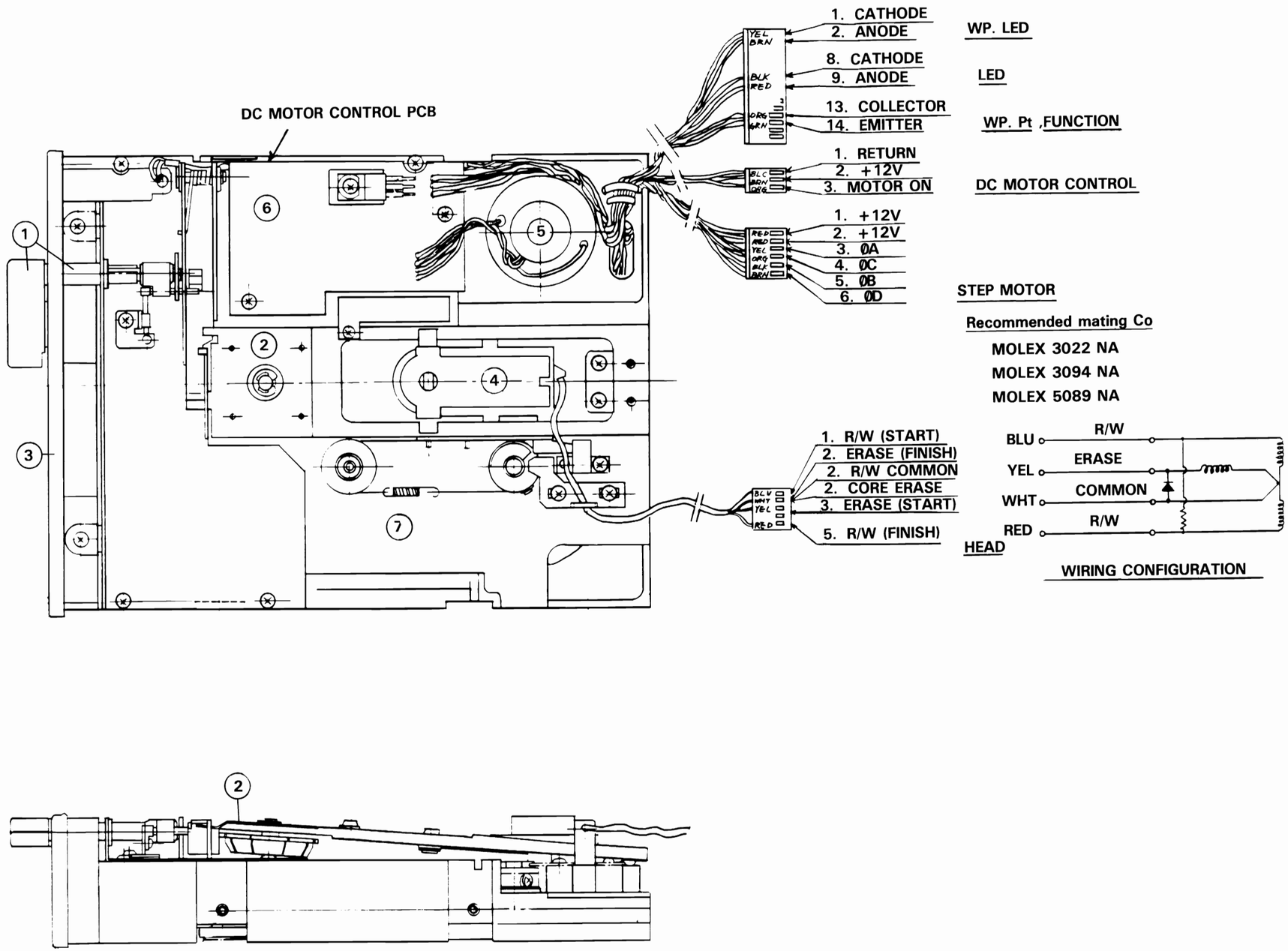
⑥ 314126-01 NWT MOTOR CONTROL PCB ASSEMBLY
- 1-Motor Control PCB
- 2-Harness Assy

⑦ 314127-01 NWT HOUSING SPINDLE ASSEMBLY
- 1-Housing Base
- 2-Spindle Assy
- 3-L/R Guide Shafts
- 4-Brass Pulley

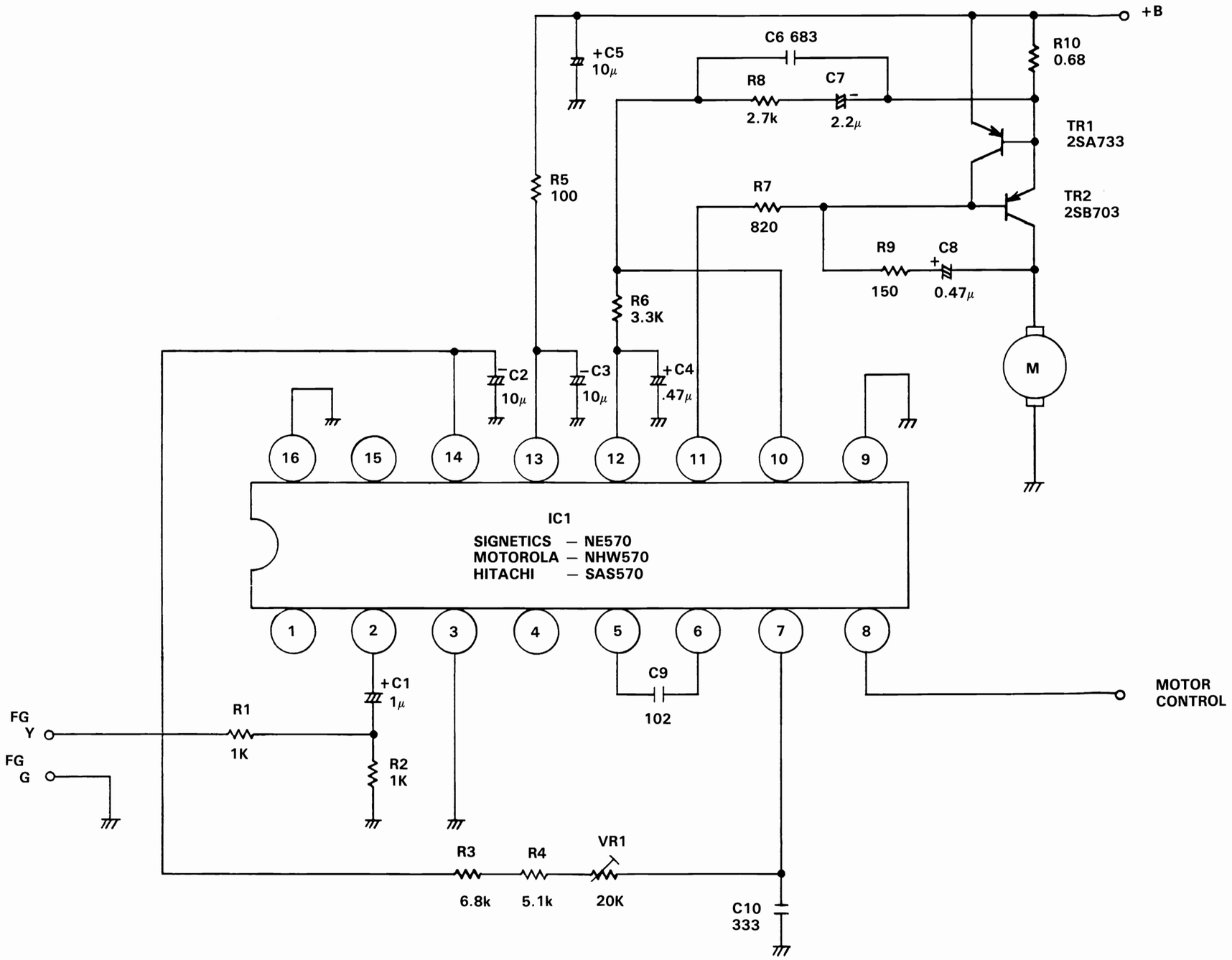
314128-01 NWT DRIVE BELT

314129-01 NWT HARDWARE
- 1-Assorted Screws
- 2-Zero Stop Tab
- 3-Tension Spring

314174-01 UNIV Replacement Load Pad



NEWTRONICS MOTOR CONTROL SCHEMATIC



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